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VIEWS, NEWS AND INTERVIEWS.

The application of the Metropolitan Street Railway Company, of New York city, for permission to substitute the underground trolley for horse-power on its lines on Sixth, Eighth and Ninth avenues and on the Belt line, was finished last week before the State Railroad Commissioners. The hearing was confined to arguments by counsel, as the taking of evidence was closed two weeks ago. Both sides will submit briefs, and a decision by the commissioners is expected before April 1.

Milton Reizenstein, a graduate student of the Johns Hopkins University, of Baltimore, has prepared a monograph as a thesis for a degree which he expects to receive next June. He has chosen for his subject the history of the B. & O. Railroad from its inception on the night of February 12, 1827, when 25 of the leading business men of Baltimore met at the home of Philip E. Thomas and devised means whereby the trade of Baltimore with the West could be restored. It was at this meeting that the company was organized which afterwards built the B. & O. Railroad. Mr. Reizenstein's monograph takes up the history of the road from that night until tracks were laid to Wheeling, W. Va., in 1853. The 70th anniversary of the B. & O. Railroad Company was February 12, 1897.

Milledgeville, Ga., is trying to raise the local tax on telegraph companies from $50 to $100 per annum. The Western Union receipts from this office last year were $700.

A number of small street railways in the vicinity of Boston are advocating a bill which will allow street railway companies of small capital, whose gross earnings do not amount to over $500,000 a year, to unite in the form of a corporation for the purpose of insuring themselves against accidents.

Frank Sutton, a former conductor for the Consolidated Traction Company, in Jersey City, N. J., is the only conductor ever prosecuted in the Hudson County courts for appropriating fares. He was arrested on a charge of embezzlement, and pleaded *non vult*. Sutton expected to escape with a fine, but when he was called up for sentence, Judge Hudspeth sentenced him to six months in the penitentiary. This was so unexpected that Sutton's lawyer took out a writ of error, although his client had practically pleaded guilty by his advice. The writ of error takes the case to the Supreme Court for review.

With the view of obtaining the current required for the electric lights in the Sub-Treasury in New York city more economically than at present, the passage of a bill now in the legislature will be followed by the construction of an electric subway in Wall street between the United States Sub-Treasury and the Custom House. The subway will enable current to be conducted from the electric plant in the Custom House. Mayor Strong has approved the bill.

The Massachusetts Gas Commissioners will permit the Edison Electric Illuminating Company of Boston to issue 5,000 shares of new stock. They have fixed the price at $120 per share.

ONE OF THE EFFECTS OF A STORM ON HOUSE-TOP TELEPHONE FIXTURES IN STOCKHOLM, SWEDEN.

The Prospects of the Horse.

[*From the New York Evening Sun.*]

A great many persons are anxious over the prospects of the horse, in case the use of the motor car becomes general. Those good souls are like the dear old lady who, when gas was first invented and the oil trade was threatened, asked, "What will happen to the poor whales?"

House-Top Telephone Fixtures in Stockholm, Sweden.

Mr. U. N. Bethell, general manager of the New York Telephone Company, has just received from Mr. H. T. Cedergreen, general manager of the General Telephone Company, of Stockholm, Sweden, a number of photographs showing the destruction of the latter company's overhead wires and fixtures during a recent severe snow-storm. Through the courtesy of Mr. Bethell a reproduction of one of these photographs is presented herewith showing how a house-top fixture, becoming overburdened by the weight of snow falling on it, gave way, and in its fall carried with it part of the wall of the house to which it was attached.

Mr. Cedergreen writes that in less than one hour after the storm commenced 3,000 subscribers' lines were out of service. The overhead pole lines leading out of Stockholm through the country were destroyed for miles. Many fixtures and buildings in the city sustained great damage. There were 1,377 wires torn from the great tower fixture at the Stockholm central office, with which telephone men are generally familiar. From a telephone standpoint this was the severest storm ever experienced in Stockholm.

Deaf-Mutes and the Morse Alphabet.

TO THE EDITOR OF ELECTRICAL REVIEW:

Mr. Codman's strictures on my remarks on the mischievous effects of the use of the touch alphabet in deaf-mute asylums are not fair. He ignored the necessity of discipline and order, "for the benefit of the pupils". Has he forgotten the penalties he paid in school for infractions of rules, or is he still of the opinion, formed in youth, that rawhide warmings and black-strap oil applications were for the "convenience of the management"?

C. C. HASKINS.

Chicago, March 16.

The Connecticut House, on March 16, passed a bill providing punishment for stealing electricity, with similar penalties to those provided for stealing gas.

TELEPHONE NEWS AND COMMENT.

The Iowa Union Telephone Company, of Davenport, Iowa, at their annual election elected the following officers: President, Joe R. Lane; vice-president, F. H. Griggs; secretary and treasurer, Aug. A. Balluff.

The Southern Illinois Telephone Company has been incorporated at Effingham, Ill., and will, it is said, at once equip a modern central office at that place. The incorporators are O. T. Kimmel, P. E. Kagay, Jr., and J. O. Patridge, Sr. The capital stock is $60,000.

The Western Telephone Construction Company, Chicago, recently did some very quick work in shipping a 300-line switchboard to the Newark, Ohio, telephone exchange, which had been destroyed by fire. A new equipment was ordered by wire and shipped the same day, accompanied by the company's experts, the result being that the interruption of the service did not last over 24 hours.

The Iowa Telephone Company has just installed a new party-line telephone system, by which it can give a service practically the same as an independent line service, at a greatly reduced cost to the patrons. Under the new system four subscribers are put on a line, and when any of the four are called, the bell of the party wanted is the only one that rings. The parties on these lines can also signal the central office without disturbing each other.

It reduces the rate to $30 per year for business telephones, and $24 per year for residences, and does away with all the objectionable features of party-line service.

It is reported that an important suit has been filed against the Cumberland Telephone and Telegraph Company, of Henderson, Ky. The petition alleges that this corporation has, since the year 1890, been the owner and holder of a legal, equitable right and corporate franchise, which has been omitted from the tax lists for State and county revenue purposes, and omitted in each of the years from 1893 to 1896, and such corporate franchise is valued at $500,000. A list was also filed showing that this corporation had omitted from the assessor's list for four years past personality that had a valuation of $650,000. A recovery of taxes is asked.

The telephone directory of the New York Telephone Company and the New York & New Jersey Telephone Company, issued by the New York Telephone Company, as of March 1, has been received by the ELECTRICAL REVIEW. It consists of 684 pages of closely printed matter, and is undoubtedly the best arranged, most complete and most compact book of its kind in the world. The list contains the names of over 32,000 telephone subscribers in New York, Brooklyn, Long Island, Staten Island, New Jersey and Westchester County, N. Y. The pages are interspersed with bits of practical advice as to the advantage of the telephone over any other means of communication, all of which are aptly and directly put.

The following facts regarding the New York & New Jersey Telephone Company are gleaned from the company's annual report, issued January 1, 1897. During the year 1896 23 new central offices were opened, a very large amount of new trunk lines was constructed and many old lines were overhauled and rebuilt. The number of stations maintained at the close of 1896 was 14,333, representing a net gain for the year of 2,450. About 94 per cent of the stations are receiving metallic-circuit service. The company's underground system in Brooklyn, Jersey City and Newark was considerably extended and new underground systems were constructed in Paterson and Orange, N. J. The number of pay stations operated at the close of the year was 2,038, representing a gain of 588 during the year. The company has purchased a plot of ground about 100 feet square on Willoughby street, in Brooklyn, on which, during the present year, will be built a substantial eight-story building to accommodate the general offices and administrative departments of the company, as well as the principal Brooklyn exchange.

The Rockland Telephone and Telegraph Company, of Nyack, N. Y., has sold its property and business to the New York Telephone Company, of New York city. William H. Russell, treasurer of the Rockland company, said that his company had been endeavoring to conduct the telephone business at rates ranging from $2 to $3 a month, and had been unable to make a success of it, for several reasons These rates were too low; the company had an isolated plant, with no connection with lines to other parts of the country, and could not get the subscribers expected. The support expected had not been received, because the chief value of telephone connection in a small place is the possibility of talking to the larger places, reached only by the trunk lines of the Long-Distance Telephone Company. The company found that it was losing money, and opened negotiations with the New York Telephone Company, which resulted in a sale of the property at a considerable sacrifice. The New York Telephone Company is reconstructing its plant in the Westchester division, and, as the lines of the Rockland Telephone Company were well built, it was deemed better to purchase its entire plant than to parallel its lines, as would have been the case in many instances.

Electrical Inspection in Chicago.

The Chicago Underwriters' Association, which heretofore has accepted the certificates of inspection issued by the "city telegraph" department, on electric light and power wiring and apparatus, will hereafter have its own inspectors pass upon such work.

Fire in the Chicago Edison Company's Station—Quick Repair Work by the Edison Company.

What at first threatened to become a most serious fire started under the floor of the dynamo room in the Wabash avenue and Twenty-seventh street station, Chicago, about nine o'clock last Saturday morning. An alarm sent in promptly, followed shortly after by a second alarm, caused the fire to be under control within a couple of hours, so that by 11 o'clock the company was enabled to commence on the work of temporarily repairing the damage and providing for service to its customers. Under the personal supervision of President Insull and Secretary Wilmerding, the work was carried on so rapidly that by 3 P. M. current was being supplied as far as Twenty-second street, and by evening the entire district (between Sixteenth and Thirty-ninth streets) was being supplied as usual, with possibly a few exceptions. The Harrison street station was, of course, called upon to supply all the current it could spare, the low-tension apparatus at the Wabash avenue place having suffered the most on account of the armatures of the large generators extending below the floor line and consequently becoming flooded with water. All of the feeder and switchboard cables were also beneath the floor and were rendered useless by having the insulation burned off. The laying of temporary cables and properly connecting them proved the most serious task, but was accomplished in a remarkably short time.

The cause of the fire is a mystery, but it is highly probable that it started in some old waste. The chances of it being due to electrical causes are so remote that such an explanation is not even discussed. President Insull estimates the probable loss at $25,000, with a possibility of it being considerably less.

Comprehensive Telephone Service.

Johnstown, Pa., is getting the most out of its telephone service, according to a local paper. Not only is a great deal of shopping done over the wire—the butchers, grocers and dry goods stores transacting a liberal proportion of their business without seeing their customers—but other utilizations are made of the exchange, which shows what an important element it can be developed into, in a community, outside of its primary purpose. For instance, if a physician is wanted, notice is given at the exchange, which follows him from one house to another with inquiries until his whereabouts is ascertained, and he is put into communication with the person who is seeking him. An equally successful side branch of the duties of the exchange is the "call-me-early" schedule, which has been arranged for the benefit of its patrons. Any subscriber who is distrustful of his power to resist the seductions of a warm bed in the early hours of the cold Winter mornings has the privilege of being called at any specified hour. The call can be made either every day or on any special day. All the subscriber has to do is to ring the exchange the day before and tell the operator. A register is kept of the different calls to be made, very much like that in vogue in hotels.

A Modern Motor Installation.

The Chicago *Record*, one of the most perfect and up-to-date newspapers, not only of Chicago, but of the entire world, has just had installed in its establishment an electric motor equipment for operating its great printing presses, which not only is the first one of its kind ever installed, but presents at the same time the highest development of the electric motor as applied to driving machinery. It should be said that, while electricity is the motive power, this power is regulated and controlled by using compressed air as an auxiliary. While the driving of printing presses by means of electric motors has come into more or less extended use all over the country, there has always been the disadvantage of requiring an operator near the rheostat for giving more or less current to the motor in case it became necessary to vary its speed for any purpose. In this installation any such possible objection has been entirely overcome, so much so that the working of the motors and accessories, when responding to the touch of a finger, seems almost human in its perfection. Two motors are geared to each press, one of 40 horse-power for driving the press, and another of three horse-power for running it slowly while the pressmen are "dressing" it; *i. e.*, placing the stereotype plates on the cylinder and feeding the web of paper through. The press can be started ahead for work without stopping the small motor, for in starting the large motor the smaller one is cut out automatically.

Each motor has the usual starting and regulating rheostat, which, as already hinted at, is operated and controlled by means of compressed air. Two small air tanks are kept filled by a compressor, and the rheostat arm is connected to the piston-rod of an air cylinder, from which a system of pipes leads to six different places on the press, where two push-button valves are located for admitting air to either end of the working cylinder, so as to move the rheostat arm up or down. In this manner the motor can be controlled perfectly from six different places on the press, and can be speeded to its highest or kept at any desired speed so as to give from five to 160 revolutions to the press cylinder. There is also an electrical push-button, placed between the two air-controlling valves, which is used in case of emergency when it is desired to suddenly stop the press. This button is connected to an automatic circuit breaker. The opening of this switch automatically gives the working cylinder air and brings the rheostat arm to the bottom. Just as it reaches a full stop it touches a valve, giving air to an auxiliary air cylinder that restores the switch to its normal position, and the rheostat is ready to again respond to the influence of compressed air.

Another novel device in connection with this installation consists of an arrangement whereby the current is shut off the motor instantly, in case the paper should break from any cause.

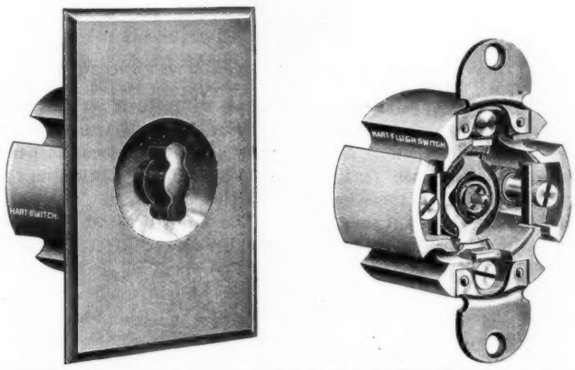
Hart Snap-Switches.

The rapid increase in the number of incandescent lights during the past few years has created a growing demand for appliances for controlling them and facilitating their use. One of the most used of these appliances is the snap-switch for placing the means of control of the lamps on an electrolier, or elsewhere, within easy reach of the hand. Not many years ago, almost any sort of makeshift that would, with more or less manipulation, light and extinguish the lamps, filled the bill, regardless of its mechanical construction or its appearance upon the wall. Of late years, however, the demand has been for a more ornamental, as well as a more durable and reliable, article. Consequently, the higher grades of snap-switches have been greatly improved in their construction.

The selection of a snap switch for use on a certain piece of work is frequently not given the importance that it deserves. It is often regarded as one of the minor and unimportant details of construction, whereas, it is one of those important details which should be settled by the selection of that switch which comes the nearest to fulfilling all the requirements of safety, durability and convenience.

The chief requisites of a snap-switch are quick and positive action when the actuating member has been turned or moved a predetermined distance, and the locking of the automatically moving parts against accidental displacement, after such action has taken place. Equally important are the "contacts", or that portion of the switch to which the terminals of the circuit are attached, and which serve to carry the current, by means of the switch-plate, to corresponding contacts, to which the terminals of the lamp circuit are attached. The contacts should have large contact area relatively to the amount of current to be carried, and should have a strong pressure upon the switch-plate, or driven member of the switch. The large area is necessary to prevent "cutting" between the switch-plate and contact surfaces, due to long use and neglect combined. The pressure is necessary in order to insure the permanency of the rated carrying capacity of the switch. If a light pressure is used, no cutting will probably occur; the switch will move freely, if the mechanism is reasonably good, and for a time it will carry its rated capacity of current without heating. In a comparatively short time, however, the surfaces depended upon to make contact will tarnish and collect dust, and their conductivity will be impaired to such an extent that the switch will heat, and become worthless.

Aside from the fact that the carrying capacity of a given area is regulated by the pressure, the pressure is also necessary in order that there may be sufficient friction to keep the contact surfaces in a proper condition to carry the current safely. Another cause of trouble is this, that if a switch-plate, or its equivalent, "makes" contact by a movement the reverse of that by which it "breaks" contact, it is liable to carry back on the contact surfaces the non-conducting metallic oxide formed by the repeated rupture of a circuit. The form of contact which more nearly fulfills the above requirements is the so-called "knife-switch". This contact should be formed by two or more pieces of tough and elastic metal of good conductivity, held rigidly by one end, while the free ends press upon opposite sides of the switch-plate, as in the usual type. These pieces should be of sufficient thickness to instantly carry off the heat produced by the rupture of the



FIGS. 1 AND 2.—FRONT AND INTERIOR VIEWS OF THE NEW HART FLUSH SWITCH.

circuit and prevent unnecessary burning at the point of rupture.

The manufacturers of the well known Hart switch, recognizing the present requirements as to quality in all the details of construction, are bringing out a new line of switches which seem to embody all the essential features of a good switch. The flush switch illustrated herewith is a sample of the new line. This switch, in addition to heavy and durable mechanism and contacts calculated to stand severe service, is also "indicating". When the switch is "on", the handle stands as shown in Fig. 1, and at right angles to that position when the switch is "off", the movement of the handle being

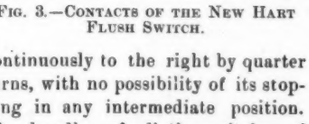


FIG. 3.—CONTACTS OF THE NEW HART FLUSH SWITCH.

continuously to the right by quarter turns, with no possibility of its stopping in any intermediate position. The handles of all the switches of the same capacity are interchangeable without affecting the indicating feature. The same rule applies to switches in gangs. The handles are of the self-adjusting type heretofore used on Hart switches. Fig. 2 illustrates the 10-ampere, double-pole switch with finished face-plate removed, showing the mechanism and contacts inclosed by the base, which is one piece of porcelain. This base is provided with channels for the wire, the bared ends of which are clamped under binding screws, accessible from the face of the switch after it is put in position in the wall. This feature greatly facilitates the installation of the switch, and especially of switches in gangs. Any switch in a gang may be connected up or disconnected and removed without disturbing the others. Fig. 3 shows the type of contact used. Each binding post is provided with a pair of spring bronze clips *c*. Each end of the switch plate B is carried between a pair of these clips by the strong and instantaneous action of the switch mechanism. The connection thus made is practically perfect. The double-pole switches are "double pole", "double break" and "double contact". Single switches and gangs of all sizes are carried in stock, with face-plates of any of the standard finishes. Any special finish can be furnished promptly.

A line of iron wall frames and iron switch-boxes for use with iron-armored conduit, is also provided. No flush switch should be placed in a plastered wall without the use of such frame or box, or its equivalent, to provide a secure attachment for the switch, and to prevent the plaster from crumbling around the edges of the opening.

The Hart & Hegeman Manufacturing Company, of Hartford, Ct., feel that, in producing this new line of flush switches, they are taking one more step in the right direction; viz., the maintenance of, and improvement in, the former good construction of the Hart switch, and they are confident that the already large number of users of that switch will be increased.

National Electric Light Association's Railroad Arrangements.

TO THE EDITOR OF ELECTRICAL REVIEW:

The Trunk Line Association has granted a rate of one fare and one-third for the round trip, on the certificate plan, from all points in its territory to Niagara Falls, for delegates and members of the National Electric Light Association attending the 20th convention, to be held June 8, 9, 10, 1897. Yours truly,

C. O. BAKER, JR.,
Master of Transportation.

New York, March 19.

The following out-of-town visitors registered at the office of the National Electric Light Association during the week ending March 19: A. Anderson, Boston, Mass.; L. Duncan, Baltimore, Md.; A. M. Young, Waterbury, Ct.; D. Whittaker, Newark, N. J.; A. J. Belden, Syracuse, N. Y.; H. Lewis, Philadelphia, Pa.

An Improved Linemen's Climber.

There would seem to be little room for improvement in a tool so apparently simple in construction as the climber used by all telegraph and telephone linemen. The same patterns have been in use for a number of years. Various makers have at times claimed some superiority in the use of material for their particular climber, but it has remained for C. H. Dicke, of the Dicke Tool Company, Chicago, to make a radical departure in the method of making climbers, using a process by means of which he obtains great uniformity in shape and quality of the tool. Believing that it was an unnecessarily expensive method to forge these out by hand, he perfected a machine at the cost of several hundred dollars, which forges the bar and completes the climber, with the exception of the spur. The strap staples on the bar are, at the same time, forged out of the solid metal and shaped up.

One of the points of weakness with all climbers has been where the hole is punched for the spur. Various attempts have been made, and claims put forth that a climber could be forged from one piece, spur and all, but this, to a practical man, is obviously an error, as by such a method the proper temper and quality of steel could not be given the spur, and on this, oftentimes, depends the life of the lineman. The Dicke Tool

AN IMPROVED LINEMEN'S CLIMBER.

Company's method is such that the steel of the bar at this point is reinforced so that after the hole is punched, there is as much weight and strength of metal remaining as at any other part of the bar. The spur is forged from the finest quality of tool steel and tempered to a point which gives it sufficient penetrating strength, without liability of breaking under severe strain. Out of thousands of pairs sold, it is said that no report has ever been received that a spur became loose.

The illustration shows the popular eastern pattern of these climbers, and, in anticipation of the great amount of construction which will, no doubt, be done this season, the manufacturers have greatly increased their facilities for manufacturing climbers, connectors, and their full line of construction tools. The Dicke Tool Company's office is at 1439 Monadnock Block, Chicago.

The Whittingham Automatic Motor Starter and Quick-Acting Switch.

The Automatic Switch Company, of Baltimore, Md., are the manufacturers of the Whittingham automatic motor starter and quick-acting switch, herewith illustrated. The operative principle of the starter is now so well known that a description is hardly necessary, but for those not familiar therewith it should be stated that the automatic movement of the rheostat is accomplished by means of a small belt connected directly with the motor, whereby each revolution of the motor armature cuts out, with absolute certainty, a predetermined part of the starting resistance.

This method possesses advantages which are of great value in elevator and pumping work, as it acts as a safeguard against too rapid starting and forcing the motor under an overload. The main feature to be commended is that the resistance is always cut out directly in proportion

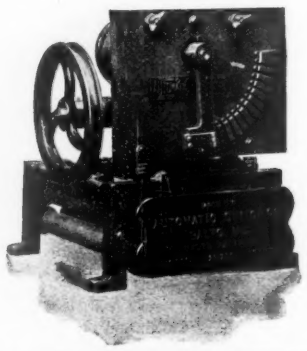


FIG. 1.—THE WHITTINGHAM AUTOMATIC MOTOR-STARTER.

to the speeding up of the motor, and can never crowd on current before the armature is prepared to receive it. The construction of the starter has been so modified as to do away with all outside wires, the resistance terminals being completely incased and protected from accidental damage, and the bearings are of graphite and require no oil.

The new type of quick-acting switch, shown in Fig. 2, embodies a number of novel and valuable points. It is designed especially for use in connection with electric pumping and elevator work, and its construction is such as to make it particularly adapted to the exacting requirements of such work. The movement required for the operation of the switch is a reciprocating one, having a stroke of about two inches, which allows the use of a sliding rod passing through bearings on the base casting, and stopping thereon at each end of stroke. The switching mechanism is thus relieved entirely from any strain or pull of the actuating rope, and is operated by the compression springs, arranged to give the quick motion when making or breaking the circuit. The contacts of the switch are pure copper castings, turned up to a true bearing surface and arranged to engage each other under spring tension, in a manner somewhat similar to the ordinary street-car controller, each set of contacts being detachable and renewable without disturbing the operating parts of the switch.

By means of this switch, in connection with the Whittingham automatic rheostat, open-tank and pressure-tank elevators may be operated automatically with satisfaction. It will also be found equally useful in maintaining a certain level in the supply tanks of automatic sprinklers, etc.

Such electric freight elevators as allow the motor to run continuously during the time the elevator may be used, can be more economically operated if arranged to be started and

FIG. 2.—THE WHITTINGHAM QUICK-ACTING SWITCH.

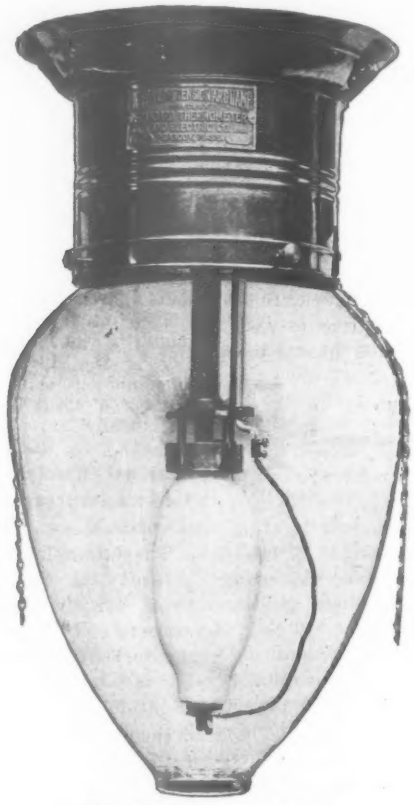
stopped from any floor as needed, and the apparatus shown is just what is required for the purpose. A rope passing up the elevator shaft and over pulleys at the top and bottom is connected to the rings of the quick-acting switch, which, in connection with automatic starter, enables any one wishing to use the elevator to safely start the motor, and afterward cut off the current consumption when it is of no service. There are instances where this saving has amounted to between $200 and $300 in one year. The automatic motor starters are made in sizes ranging from two horse-power to 30 horse-power, and the switches supplied in two capacities; viz., 20 amperes and 60 amperes.

The Automatic Switch Company will shortly put upon the market a new form of automatic reversible controller and reversing switch, which combines many desirable features, and will furnish reliable means of automatically handling elevator motors without the use of dash-pot or moving magnets.

The "Midget" Arc Lamp.

The desideratum in arc lamps for interior lighting is the combination of quiet burning and efficiency with beauty and small size. The success of the inclosed arc lamps has been due to their quietness and efficiency, their steadiness of light and adaptability to incandescent circuits at the usual voltages. The competition between makers is leading rapidly to the selection of designs of extreme elegance for the exteriors of these lamps, while their increasing use in interior lighting has necessitated the shortening of the lamp to permit its suspension under low ceilings and in confined spaces.

The lamp illustrated herewith is the Upton "Midget" lamp, made by the Standard Thermometer and Electric Company, Peabody, Mass. It combines elegance of design with very small size and the most extreme simplicity of construction. The mechanism of the lamp consists of a single solenoid which operates a lever connected with a clutch. At the end of the lever is a dry-air dash-pot. The upper carbon is held in a brass tube, by a suitable holder, provided with brushes bearing against the interior of the tube. The clutch embraces the carbon at its point of entrance into the inclosed chamber of opal glass surrounding the arc, and is insulated to prevent the formation of an arc between carbon and clutch. A single movement of the lower carbon-holder unlocks it from the inclosure globe and permits the trimming of the lamp. The resistance coil, used for lamps on constant potential circuits, is mounted in the upper case above the solenoid. The lamp, complete with the outer globe, is only 20 inches high, and without the globe, 18½ inches. A special form for show windows is made, with concave or convex reflectors replacing the outer globe, to replace the ordinary group of incandescent lamps mounted in a mirror reflector.



THE "MIDGET" ARC LAMP.

The "Philadelphia" Insulator and Tie.

In the accompanying illustration is shown a novel method of tying line wires, made by the Philadelphia Insulator Company, of Philadelphia, Pa. The tie, in its operation, seems to be similar to the stopper device ordinarily used on beer bottles. The tie is made instantly, by the snap of the lever, or is unmade in the same manner. A number of ties on a line

THE PHILADELPHIA INSULATOR AND TIE.

can be simultaneously made. The tie adapts itself to the position of the line wire by means of the movable band on the insulator being turned to any desired position to conform with the line wire.

In new work it is the practice to have gangs of as many as five men on the poles, and when ready to make their ties, they tie in succession, the second man awaiting word from the first before he makes his tie, and so to the fifth, or last. It will take an expert lineman two minutes to make a good tie, thus requiring an average of 10 minutes for each tie made. With the "Philadelphia" the tie is made so readily as to admit of the five ties practically being made simultaneously. This means a saving of time of practically 50 minutes for the five ties.

In repair work, where the former tie must be removed, it requires about two minutes to remove the old tie, and at least as much more time to make the new one. The old tie is of no further use, and if of copper, has cost at least one cent. A new copper tie will cost as much more, or, in all, two cents for ties to replace one removed. It is claimed that with the device illustrated the tie can be made or unmade any number of times without impairment. Practically no time is required in making or unmaking them.

A LARGE NUGGET OF PLATINUM.

INTERESTING FACTS RELATIVE TO THE SUPPLY AND CONSUMPTION OF THIS RARE METAL.

A recent shipment of crude platinum, consigned to Baker & Company, the platinum refiners, of Newark, N. J., contained a nugget which is believed to be the largest ever exhibited in this country. This nugget, illustrated herewith, is, as usual, of irregular form, measures approximately three by two by three-quarter inches, and weighs nearly two pounds. It is now on exhibition at the New York office of the above-named firm, 121 Liberty street, where it is attracting the attention of metallurgists and the admiration of all who are interested in mineralogical curiosities.

It may be of interest to the general reader to learn that platinum ore is a most complex mixture of mineralogical species, and includes not only a number of heavy reguline ingredients, such as platinum iridium, osmiridium, palladium, rhodium and gold, but also certain non-metallic species, notably chrome iron ore, magnetic oxide of iron, zircon corundum and, frequently, diamonds. Because of its complex composition the ore has received the surname of "polyxine".

The heavy reguline ingredients are rarely found, except in the form of small detached granules; the most notable exception to this rule being a nugget of Russian ore, now in the Demidoff Cabinet in St. Petersburg, weighing between seven and eight kilograms. The average yield of metallic platinum from the ore varies between 50 and 80 per cent.

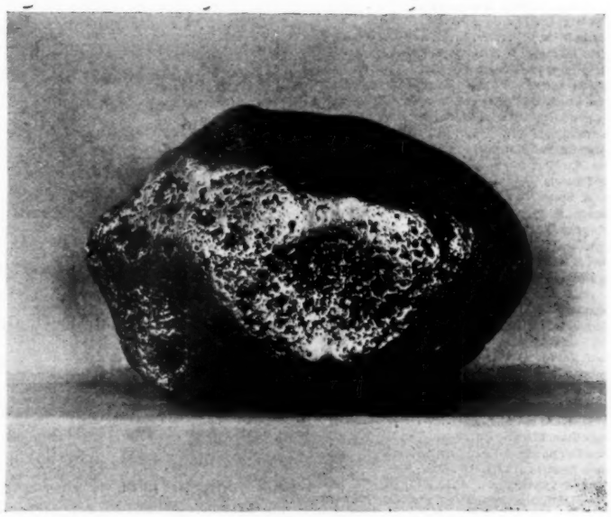
Platinum was first discovered in a Spanish mine of South America, early in the sixteenth century, from which source it received its name, "platina del pinto" (little silver from the river Pinto). The ore is now found in various parts of the world, but the richest deposits are those of the Ural Mountains, which have been worked under the supervision of the Russian Government since 1828.

The platinum of commerce is obtained entirely from alluvial deposits at depths varying from 6 to 40 feet. The sand and gravel of former river beds are subjected to a series of screenings and washings, to effect the separation of the ore; most of this labor in Russia being done by women. The yield of the ore per ton of sand seldom exceeds six grams. Sand yielding less than three grams per ton is rarely worked with profit. All Russian ore pays a government tax of three per cent, in the form of the ore mined, and any person possessed of the ore without a license is subject to imprisonment and confiscation of the metal.

Platinum occupies a unique position among metals. When pure and in compact form, it is tin-white in color. It is the heaviest and has the highest fusing point of any metal in commercial use unalloyed. Its specific gravity is 21.5; it is, therefore, twice as heavy as silver and nearly three times heavier than cast-iron. A temperature of nearly 1,800 degrees centigrade, or 3,300 degrees Fahrenheit, is necessary to fuse the metal, hence it is unaffected by temperatures attained in the hottest of blast furnaces. This valued property has led to the extensive use of the metal in such furnaces, as an important part of an instrument for measuring temperatures.

Platinum ranks fourth as a conductor of heat and sixth as a conductor of electricity among metals. It expands and contracts under variations of temperature less than any other metal, and because of this fact, its high fusing point and non-oxidability, platinum is the only metal that can be successfully sealed into glass vacuum apparatus.

Platinum is almost as soft as copper and ductile as gold. It can easily be rolled into sheets so thin that 1,000 of them piled on top of each other would not exceed an inch in height. It is daily drawn into the form of wire not exceeding one-thousandth part of an inch in diameter.



A LARGE NUGGET OF PLATINUM.—ACTUAL SIZE.

For use as "spider lines" in optical instruments, platinum is drawn by a special process to diameters as small as sixty-millionths of an inch. Such wires are nearly invisible to the unaided eye. A strand of it of sufficient length to encircle the earth at the equator would only weigh 46 ounces.

Platinum is not attacked by any single ordinary acid, and is not changed by air, water or steam at any temperature. Because of its many peculiar qualities, it is one of the most valued metals made available to man's wants, and, notwithstanding its excessive cost—the present market price being $14 per ounce—its yearly consumption is rapidly increasing.

Its rate of consumption may, in a sense, be regarded as an accurate index of the progress of civilization. Eminent statisticians have been wont to measure such progress in terms of pounds of iron consumed per capita; but it should not be forgotten that the consumption of iron, aside from an abundance of the ore, has been and must continue to be dependent upon the cheapness and quality of the product. To the chemist must be accredited primarily much of the marvelous advance in this field. But the chemist would be practically helpless in much of his work without the aid of platinum. In the words of Liebig, the eminent German chemist, "Without platinum it would be impossible, in many cases, to make the analysis of a mineral. The mineral must be dissolved, and it must be first rendered soluble, or prepared for solution. Now, vessels of glass, of porcelain and of all non-metallic substances are destroyed by the means we employ for that purpose. Crucible of gold and silver would melt at high temperatures, but platinum is cheaper than gold, harder and more durable than silver, infusible at all temperatures of our furnaces, and is left intact by acids and alkaline carbonates. Platinum unites all the valuable properties of gold and of porcelain, resisting the action of heat and of almost all chemical agents. Without platinum the composition of most minerals would have yet remained unknown." Platinum is preeminently the metal of the chemist, both in analytical and industrial operations. No chemical laboratory is complete without a varied assortment of platinum apparatus, and fortunes are annually invested in platinum retorts for the commercial concentration of oil of vitriol. Chemical operations alone consumed, until within a few years, the bulk of the metal produced.

The dental and electrical industries, which have progressed so rapidly within recent years, are said at the present time to consume, in the United States alone, more than half of the world's supply of platinum. In the manufacture of artificial teeth, platinum pins are used to fasten the porcelain teeth to the supporting plate during the process of baking the porcelain. Platinum is the only metal available for this purpose, because of the high temperatures required. It is also used in the form of thin foil, for taking the impression of cavities in natural teeth which are to be subsequently filled with baked porcelain, and still more extensively in the form of muffles, to protect the baking porcelain from direct contact with the fire or the products of combustion, which would discolor the porcelain.

Platinum has played a most important part in the development of the incandescent lamp. It was early used as the light-giving body of the lamp, but subsequently yielded this position to carbon, because of the latter's higher electrical resistance, higher fusion point and lessened cost. Although now occupying a less prominent position in the modern lamp, it is, nevertheless, one considered as essential in the construction of a successful lamp. Many devices have been tried to avoid its use, but without commercial success.

Metal conductors are required to convey electric energy through the glass walls of the incandescent lamp to the light-giving carbon filament within. Since the maintenance of a vacuum within the lamp bulb is essential to the life of the lamp, it can be readily understood that the leading-in wires sealed into the glass must have a higher fusing point than glass; must unite closely with it, hence must not oxidize at high temperature, and last, and a most important feature, the metal must expand and contract under variations in temperature, so nearly at the same rate as the glass in which it is imbedded, as to insure freedom from crackage of the latter and consequent leakage of air into the lamps. Here, again, platinum proves to be the only metal that fulfills all of these essential requirements, and hence its contined and increasing use in spite of its high cost, which a limited supply enforces. Radical changes in the construction of incandescent lamps have reduced the consumption of platinum per lamp enormously, but, on the other hand, the production of lamps has increased in greater proportion, and the aggregate consumption is greater than ever before in that industry.

The telephone, telegraph, and, in fact, almost all of the electrical industries, are yearly making heavier demands upon the limited supply of the metal. Physicians require it in cauteries and surgical instruments where extreme cleanliness is important.

To enumerate the many and varied uses of platinum and its salts would extend this article beyond reasonable limits. Suffice it to add that the latest application of its peculiar properties is due to Roentgen's discovery, that certain invisible rays of energy, when allowed to fall upon one of the double salts of platinum (barium-platino-cyanide), renders the same luminous, so that a screen of paper covered with this salt and exposed to the action of Roentgen rays serves for the production thereon of a shadow picture of many objects of variable density which may be interposed between the screen and the source of the Roentgen rays. Metallic platinum is also a most important factor in the construction of Roentgen-ray apparatus, both as a means of conveying electric energy into the vacuum chamber and as a source of excitation of the X or Roentgen rays. Thus, in this most recent development of the agencies for anatomical and physical research, platinum plays a most important part; one of which largely enhances its utility and value to mankind.

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Special Notice to Advertisers.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

NEW YORK, MARCH 24, 1897.

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The X rays are helping out electric railway companies in claims for alleged personal injuries. A man asked a Baltimore company for $3,500 damages for the alleged breaking of his arm. He was offered $100 as a compromise, and refused it, and was then subjected to the test of the X ray, which showed that his heavily bandaged arm was not broken and never had been. Then he offered to settle for $25, but the company was no longer in a compromising mood.

THE GAS ENGINE.

The modern gas engine as an adjunct of electric lighting has become well established, and its popularity is ever increasing. The details of construction are better understood than formerly. Not many years ago the regulation was the great drawback to the use of gas engines in driving electric lighting dynamos. But this has all passed, and to-day there are a number of makes of gas engines whose performance is up to the standard of regulation required in successful lighting. Their efficiency is high, maintenance easy, wear and tear moderate, and they have a field of their own, being well adapted for use where a steam plant would be costly.

The idea of direct connection has obtained foothold, too, and to-day there are many compact little plants of this type of gas engine and dynamo. Sizes formerly unheard of are common nowadays. It is nothing now to see a gas engine of 100 actual horse-power, and several builders are ready to make engines up to 300 horse-power.

Naturally, it would seem to be the very thing for small electric railways, but there is an obstacle, as yet not overcome, we believe. The gas engine can not handle any considerable overload, and when such strain comes on it the engine stops. Overloads are almost of the essence of electric railway operation, especially on those operating but few cars. For the present, then, the application of gas engines for the generation of current for electric railways is very limited. The maximum load, even on a small plant, is always doubtful, and it will not pay to install an engine large enough to easily handle a maximum load within its rated power, when the average load is, perhaps, less than half as much. But it is not at all unlikely that some inventor will yet overcome this obstacle and give the gas engine something equivalent to that feature of a steam engine which will enable it, for short periods, to respond to demand for power far in excess of its rated load. Once this is effected, the field of usefulness in railway work, for gas engines, will be greatly enlarged, and an important improvement will result for such plants as now suffer from want of facility for getting coal or water. And we believe the time is near at hand. We believe in the gas engine.

On Monday of this week the advent of Spring was heralded in Washington, D. C. The flowers bloomed, the grass was green, the Supreme Court of the United States convened at high noon—but there was no decision in the Berliner case.

THE ENERGY OF THE X RAY.

PROFESSOR TROWBRIDGE'S EXPERIMENTS.

With the view of getting more definite information as to the line of electrical theories which Professor Trowbridge, director of the Jefferson Laboratory of Harvard College, is developing, a representative of the ELECTRICAL REVIEW called upon him at the Jefferson Laboratory late in the afternoon, after his important work of the day was over, and while the interviewer was being shown the new apparatus for electrical demonstration, which has been constructed, Professor Trowbridge gave a general talk upon the work on which he is now engaged.

"I have succeeded," said he, "in perfecting this battery of 10,000 cells of the Plante type, arranged, as you see, in three large frames with shelves, and the switching is so adapted that any number, from one to 10,000 of these cells, which are of two volts each, may be thrown in circuit. This permits experiments with varying voltages of from two to 20,000. In constructing this battery, each cell is placed in a block of wood, which has been boiled in paraffine, the glass jar setting into a hole which has been partially filled with cooling paraffine. In the cells the lead plates descend only partially to the bottom, as a preventative, in case of the falling of a portion of the lead, against short-circuiting. The conductors of these cells leading away from the battery are of lead, so as to guard against corrosion by fumes, and the plates are separated by rubber bands.

"In connection with this we have an apparatus for charging Leyden jars in parallel and then discharging in series, so that the whole power of the battery may be used in charging a case of 30 Leyden jars, and then by the use of a machine which may be called an electrical accumulator, the total energy of the discharge is obtained and this total produces a spark with an energy of 500,000 volts.

"In endeavoring to discover the amount of energy," continued Professor Trowbridge, "required to produce the X ray, I used a camera 10 feet long, a Crookes tube and a revolving mirror operated by a motor. I photographed the X ray. By throwing the ray on the mirror, revolved very rapidly by a motor, the light was diffused over the photographic plate instead of striking in a mass. The photograph thus obtained showed an electric spark spread out in its constituents. Each spark proved to be made up of 10 or 12 parts. The amount of time represented between the impressions of each spot on the plate of the camera was about one-ten-millionth of a second. This experiment not only furnished the data for computing energy, but it also proved that when the tube was giving out X rays the current was oscillating. In place of the Crookes tube a piece of fine wire about a foot in length was inserted. Photographs of the spark under these conditions were taken and the wire

was lengthened until the number of spots appearing on the photographic plate was identical with the number shown in the photograph of the X ray. In this way was obtained the amount of resistance of a Crookes tube.

"The impression of each spark on the plate shows that the amount of time represented between them, corresponding to the oscillation, is about one-ten-millionth of a second, and shows each spark made up of 10 or 12 sparks.

"This experiment of getting negatives of sparks under different pressure and the comparative study shows conclusively the amount of resistance offered by the various elements to the current, and also shows that when the tube is giving out X rays the current is oscillating."

"What are the most important theories which you have deduced from this line of experiment?" asked the interviewer.

"I think the important conclusions," replied Professor Trowbridge, "are that I have been able to determine the energy in terms of horse-power. One million horse-power in one-ten-millionth of a second is the energy required to produce the X ray. In view of this great power, it is not strange that X rays will pierce flesh and brick walls. I have also found that when the electrical discharge is forced across a vacuum by a great pressure, the vacuum breaks and is a good conductor, and, at the moment before the discharge goes, from one end of the tube to the opposite the greatest resistance exists, while at the instant of transversing the resistance is practically broken. And still another point I have demonstrated is that a spark eight inches long does not encounter more resistance than a spark one inch long."

The Underground Trolley in New York City.

On March 20 the New York State Railroad Commissioners granted permission to the Metropolitan Street Railway Company, the Central Park, North and East River Railway Company, the Eighth Avenue Railway Company, the Ninth Avenue Railroad Company and the Sixth Avenue Railroad Company to use the underground trolley system on their roads. The decision covers about 40 miles of street railroads in New York city upon which the motive power is to be changed. As soon as the consent of the Commissioner of Public Works for tearing up the streets is obtained, work involving the expenditure of between $6 000,000 and $7,000,000 will be commenced.

Mr. M. L. Livingston, of the Standard Thermometer and Electric Company, Peabody, Mass., has made a flying trip to Syracuse and Rochester and through New York State, making arrangements for the introduction of the new Upton "Midget" inclosed arc lamp. Mr. Livingston left Chicago within the past year, where he had been indentified with the American Glue Corporation, and prior to that with the *Northwestern Lumberman*, to accept his present connection with the Standard Thermometer and Electric Company as assistant business manager.

An Improved High-Frequency Coil.

To one who has investigated the various methods of exciting X-ray tubes, the early difficulties encountered in making an efficient tube seems not so surprising. The only instrument then available for excitation being the induction coil, it was then, as it is now, an extremely delicate undertaking to secure and maintain the right degree of vacuum.

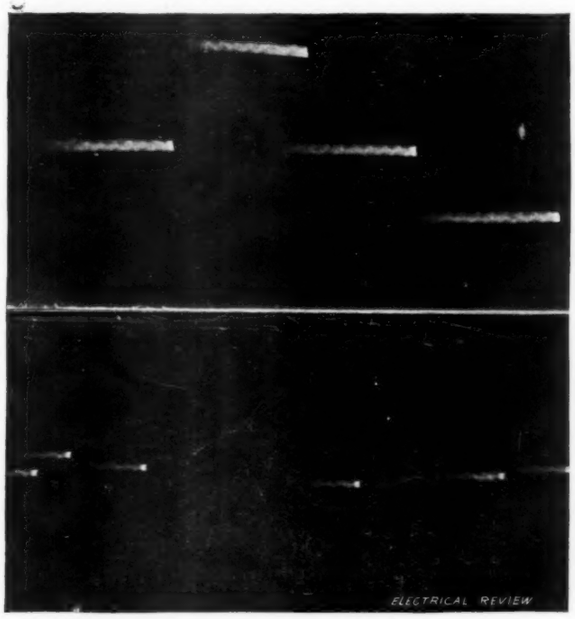
Both manufacturers and manipulators of the induction coil agree that the correct exhaustion is the all-important consideration. This difficulty, being apparently insurmountable, induced the laboratory department of the L. E. Knott Apparatus Company, of Boston, to continue its investigations, in order to still further perfect the high-frequency coil. It was early shown that with this instrument the question of vacuum was not of such great importance as had been supposed, the rapidity of discharge being sufficient to produce good X-ray power with any reasonable degree of exhaustion.

During these investigations a new and simple method of discharging the condenser with uniformity and rapidity was developed. The early coils of Hertz, Tesla and others employed numerous devices for producing this effect, some of which were quite complicated. With these devices the "tuning" or changing the capacity of the condenser to meet the varying conditions of the current was a difficult undertaking. Fortunately this new device rendered this entirely unnecessary, as it was found by the L. E. Knott Company that the rapidity and power of discharge could be easily regulated by simply closing or opening the spark gap. It is believed that it is this device which has made the high-frequency Tesla coil one of the most successful X-ray generators and a practical instrument for hospital and surgical use.

Since this coil may be operated by an alternating current, it has been supposed by some that sharp definition was not to be obtained. The results of many well known investigators, among whom are Mr. O. B. Shallenberger, of Rochester, Pa., and Dr. F. F. Strong, of Boston, prove beyond question the error of this belief. In fact, looked at from the standpoint of penetrating power, clear definition, ease and convenience of operating, the high-frequency coil commends itself to all practical workers.

A New Form of X-Ray Apparatus.

At the Spring Park Laboratory, Jamaica Plain, Mass., Mr. T. B. Kinraide has completed a somewhat radically new form of X-ray apparatus, which will permit a new method of supplying the current. The improvement principally is in the method of constructing the coil. The apparatus consists of an induction coil, in appearance like the ordinary coil, and a rotary, which may be mounted on the shaft of a hand-power dynamo supplying current for operating the coil. The plan of the apparatus is a portable outfit, such as one or two men could carry, which might be used by surgeons or hospitals or for army use. When operated by two men it is said that it will give more power than any X-ray apparatus yet made. The machine may be used with any voltage, and a feature is the perfect control of the discharge, which is of very high potential, through a tube which may be varied from the most powerful, passing through bone and flesh, or may be reduced until the flesh is merely opaque, and the vacuum in the tube being extremely high, perfect definition is obtained.



THE ENERGY OF THE X RAY.—THE TOP PICTURE SHOWS A PHOTOGRAPH OF A SPARK DISCHARGED IN A VACUOUS BULB. THE LOWER ONE SHOWS A SPARK DISCHARGED IN HYDROGEN GAS.

Brooklyn, N. Y., apparently holds the season's record for placing Summer cars in service in this latitude. On Sunday, March 21, both the Brooklyn Heights and the Nassau companies put open cars in commission during the middle of the day. They were splendidly patronized.

PERSONAL.

Mr. A. C. Bunce, Milwaukee manager for Donley & Bunce, Chicago, reports business in the northwest as slowly but surely increasing.

Mr. Eugene H. Lewis, a prominent patent attorney of New York city, and Miss Amy Busby, the well known actress, were married at Rochester, N. Y., on March 19.

Col. Gardiner C. Sims, of the Armington & Sims Engine Company, Providence, R. I., has been for some days at Lakewood, N. J., recuperating from an illness serious enough to compel him to withdraw from business cares for a time.

Prof. F. B. Badt, of Chicago, secretary of the Siemens & Halske Electric Company of America, has the sympathy of his many friends on the recent death of his mother in Germany. Professor Badt's mother was 72 years of age, and her death was caused by pneumonia following an attack of the grippe.

Mr. Abner McKinley, brother of the President, is largely interested in the electrical business, being a stockholder in McGuire & Baucus, Limited, of New York and London, the foreign representatives of Mr. Edison and the manufacturers of MB copper. Mr. McGuire, of this concern, was also formerly the private secretary of President McKinley.

The numerous friends of Mr. Wm. E. Smith, formerly with the National Electric Company, Eau Claire, Wis., will be glad to hear of that gentleman's rapid rise and success in his new field of work, at Cairo, Ill., where he has just been promoted to the position of manager of the Three-State Lumber Company, one of the biggest concerns in that city. While with the National Electric Company, Mr. Smith became universally esteemed for his many sterling qualities, and it is to be regretted that he is no longer actively engaged in the electrical business.

American Bell Telephone Company.

The directors of the American Bell Telephone Company, at Boston, on March 17 voted to submit to the annual meeting of stockholders the question of sanctioning a further issue of stock at an upset price to be named by the Commissioner of Corporations, as heretofore. The present outstanding capital is $23,650,000. The amount authorized is $50,000,000. The regular quarterly dividend of $3 per share was declared, payable April 15 to stockholders of record March 31.

American Institute of Electrical Engineers.

The 114th meeting of the Institute will be held at 12 West Thirty-first street, New York city, on Wednesday, March 24, 1897, at eight o'clock P. M. A paper by Dr. Karl E. Guthe will be read by Prof. Henry S. Carhart, of the University of Michigan, entitled, "The Influence of Heat Treatment upon the Magnetic Properties of Hardened Steel."

SOME PRACTICAL ASPECTS OF ELECTRICAL RESONANCE.

READ BEFORE THE CHICAGO ELECTRICAL ASSOCIATION, MARCH 5, 1897, BY KEMPSTER B. MILLER.

It is not the purpose of this paper to treat of the phenomena of resonance in electric circuits, from their purely mathematical and theoretical standpoint, that field having been covered in a masterly style by men far more competent to do so than the writer. For very full and interesting discussions of this subject from these points of view I refer you primarily to the articles of Dr. M. I. Pupin, Frederick Bedell, Houston and Kennelly, and Francis W. Dunbar.

I trust I may be pardoned if, in outlining the underlying principles of resonance with as much brevity as is consistent with clearness, I go over a field already covered very thoroughly by others. Analogies and illustrations have been borrowed wherever they seemed to be appropriate, and in the first part of this paper, at least, no attempt has been made at originality.

The phenomena of periodic electric currents in general have almost perfect analogies in the various phenomena of sound, and the further we go into the subject the more beautiful do these analogies appear. Dr. Pupin and others have shown excellent judgment in adopting the terms used in acoustics. For instance, they speak of fundamentals, of harmonics or overtones, of resonance, of resonators, of consonance, and of "tuning" the electric circuit. Nothing can be more apt than the way in which these terms have been applied.

Just as every string or reed in a musical instrument has its natural and fixed rate of vibration, so every electrical circuit containing self-induction and capacity has its natural rate of vibration. By natural rate of vibration of a circuit we do not mean the rate at which the material particles of that circuit would vibrate if suddenly released from mechanical stress, as in the case of the plunking of the violin string, but the rate at which an electric current will oscillate in that circuit if the neutral condition of its electric state be suddenly disturbed.

Self-induction in a circuit causes the phase of a periodic current flowing in it to lag behind the impressed electro-motive force. If we have a circuit devoid of self-induction and capacity, the current flowing will be in exact phase with that of the electro-motive force producing it; that is, the current value at any instant will be in direct proportion, by Ohm's law, to the electro-motive force impressed upon the circuit. Insert a self-induction coil, and the current lags in phase behind the impressed electro-motive force. The maximum and minimum values of the current now occur slightly after the maximum and minimum values of the electro-motive force.

Take out the self-induction and substitute a condenser, so that the circuit will possess capacity. The phase of the current will now be slightly in advance of that of the impressed electro-motive force, and its maximum and minimum values will occur a little before the corresponding values of the electro-motive force. It is seen, therefore, that self-induction and capacity have opposite effects on the current, the first causing a lag and the second a lead. A little thought will suggest that it is possible to neutralize the lag due to self-induction by the lead due to capacity. In other words, in a circuit with a coefficient of self-induction sufficient to cause a certain alternating current to lag, say, 75 degrees behind its impressed electro-motive force, it will be possible to insert enough capacity to cause a lead of 75 degrees in the phase, thus bringing the current again in phase with its electro-motive force. When such a condition of affairs exists, the current flowing is a maximum, and as it is in phase with the electro-motive force, it follows Ohm's law:

$$C = \frac{E}{R}.$$

It is found that the amount of capacity which will thus counteract the effects of a certain self-induction, or, vice versa, the amount of self-induction which will counteract the effects of a certain capacity, will do so for one particular frequency of alternation only. For every circuit, therefore, containing a given coefficient of self-induction and a given capacity, there will be one particular frequency, and one only, for which the current will be in phase with the impressed electro-motive force, and will strictly follow Ohm's laws. The current flowing in such a circuit will be greater for that frequency than for any other with the same impressed electro-motive force.

The period of the alternations (*i. e.*, the time taken for one complete cycle) at this frequency is found to be the natural period of the circuit. If a part of such a circuit be subjected to a constant electro-motive force, it will become charged. If now the source of electro-motive force is suddenly removed, the circuit will be discharged and the discharge will be of an oscillatory nature. Instead of the potential difference simply decreasing to its normal value, the electro-magnetic inertia, due to self-induction, will cause the current to go beyond the zero point and build up a potential difference of the opposite sign. A discharge will then take place in the other direction and again pass the neutral point. The cycle will be repeated, each maximum being slightly smaller than the one before. An alternating current of decreasing amplitude thus follows for a very brief space of time until equilibrium is restored. The period of these oscillations is independent of the amplitude of the vibration, and is the natural period of the circuit.

We disturb the mechanical equilibrium of the violin string and it vibrates with a certain fixed rate until it comes to rest; just so we disturb the electrical equilibrium of our circuit and a current is set up that oscillates at a fixed rate until it dies out.

Let us take another mechanical analogy to show even more clearly how this oscillatory discharge takes place. Referring to Fig. 2, we have a ball A sliding on a horizontal wire. Two rubber bands *a a*, each attached at one end to the ball and at the other end to one of the pins *p p* located at the ends of the wire, serve to hold the ball normally in the center of the wire. Bearing in mind that capacity in an electric circuit has a direct analogy in inertia, we will consider what happens when the ball is displaced from its normal position and suddenly let go. The potential energy of the ball, due to the tension of one of the rubber bands, is rapidly changed to the energy of motion (kinetic energy), which is greatest when the ball passes through its central position. At this point its potential energy is zero, but its inertia keeps it moving, and as it moves farther it loses kinetic and gains potential energy until the former is zero and the latter is a maximum. The other rubber band then starts the ball back, and so it oscillates with a fixed period until equilibrium is restored. Returning to our circuit, the condenser stores up potential energy when charged. In discharging, the self-induction will not let the current stop when the potential is zero, and, like the ball, the current goes surging back and forth through the circuit with a certain fixed rate of vibration. Just as the rate of vibration of the ball depends solely on its mass and on the elasticity of the rubber bands, so the rate of vibration of the current depends solely on the self-induction and capacity of the circuit. We may carry this analogy still farther by comparing the friction of the ball on the wire to the ohmic resistance of the circuit.

These points were, so far as I am able to ascertain, first made known by Maxwell (proceedings of the Royal Society, 1868). He simply proved that self-induction could be neutralized by a proper capacity, and gave the formulas.

It is well to state here that the formula for determining the natural period for a circuit containing a given co-efficient of self induction and capacity is

$$T = \frac{2\pi}{10} \sqrt[3]{LC},$$

T being the length of the period in seconds, L the co-efficient of self-induction in henries, and C the capacity in microfarads.

Now, what is resonance? Resonance means what its name implies; simply equality of vibration—synchronism. In acoustics a state of resonance exists when one vibrating body is so adjusted or tuned that its natural rate of vibration corresponds to that of some sounding body near it. In alternating-current phenomena a state of resonance exists when the natural period of a circuit containing self-induction and capacity is so adjusted or tuned as to be equal to the rate of vibration of the periodic electro-motive force impressed upon it. By tuning a string, we simply adjust its tension or its mass so as to bring its natural rate of vibration into equality with that of, say, a tuning fork. By tuning a circuit, we simply mean varying its self-induction or capacity so as to bring its natural rate of vibration into equality with that of its impressed electro motive force.

Pupin has shown that this tuning of the circuit offers a new and simple method of transforming electric energy from a low to a high potential. Referring to Fig. 3, we have an alternator A giving 600 volts in circuit, with the primary coil of a step-down transformer, the ratio of transformation between the primary and secondary of this transformer being as six to one. In the secondary circuit is an impedance coil D and a condenser C. Under ordinary circumstances the voltage impressed on this circuit is 100. As the speed of the machine is gradually increased, however, the condition of resonance is approached and the voltage, indicated by the voltmeter placed around the condenser, begins to rise. The critical point is quite sharply defined and is indicated by a voltage of over 3,000. A further increase of speed causes a very rapid falling off of the voltage. This rise of potential is very easily explained by referring again to our ball and elastic bands. Suppose that at every vibration of the ball a new impulse were given it, and that these impulses occurred in exact synchronism with the vibration of the ball. It is easy to see that the amplitude of these vibrations will become larger and larger even though the periodic impulse be very small.

Another analogy is in the swinging of one person by another in an ordinary swing. A slight push recurring at the proper interval will finally raise the swing to almost any desired height. Just so in a circuit when the impressed electro-motive force is in resonance with the natural period of that circuit, each impulse given to the circuit serves to push or boost the already existing impulse along until almost any desired voltage is obtained. This phenomenon is the cause of many serious breakdowns in the insulation of cables. When, for any reason, an alternating electro-motive force is impressed upon the cable, the periodicity of which exactly corresponds to the natural periodicity of the cable, the voltage is likely to rise to such an extent as to break down almost any insulation. This is known as the disruptive discharge in cables.

One of the most difficult problems of the day, and one that is declared by many of our leading engineers to be impossible of solution, is that of transoceanic telephony. The cables now used have an enormous capacity and, as a result, it is absolutely impossible to transmit through them alternations of great rapidity. High-speed telegraphy is at present impossible, and telephony simply out of the question. This, in spite of the assertion of our new Russian friend with the unpronounceable name. Prof. Sylvanus P. Thompson long ago advocated the theory that ocean telephony is possible—that the capacity of the cable can be neutralized by self-induction to such an extent that vibrations of any desired frequency can be transmitted. To be sure, the capacity of the cable is distributed over its entire length, but, as Professor Thompson says, the only way to remedy a distributed evil is to apply a distributive remedy. He proposes to insert in the cable at intervals of sufficient frequency (say five or ten miles) self-induction coils, so as to neutralize the capacity of the cable. From what has already been said, it will be seen that it is possible in this way to make the cable resonant for one frequency only, and it would thus seem that this method would render possible the transmission of but one particular tone, thus making it available for high-speed telegraphy, but not for telephony, as the vibrations composing articulate speech, with their various harmonics, have a range of several octaves. It may be stated, however, that, with a large capacity and a small self-induction, the critical period of vibration is not so sharply defined, and that we might make it possible for such a cable to transmit efficiently a comparatively wide range of vibration in the upper register, so to speak.

No one realizes better than myself that certain problems that have more or less engaged the mind of man are impossible of solution. For instance, perpetual motion. But it does seem that, in view of the wonders accomplished within the last quarter of a century, one is saying too much when he announces that transoceanic telephony is an impossibility and will never be accomplished. As Professor Thompson says, "It is contrary to the scientific spirit of progress to admit that any of its developments are final."

Professor Dunbar has shown the

advisability of making the electrostatic and electro-magnetic constants of a line neutralize each other for the particular frequency to be transmitted over it.

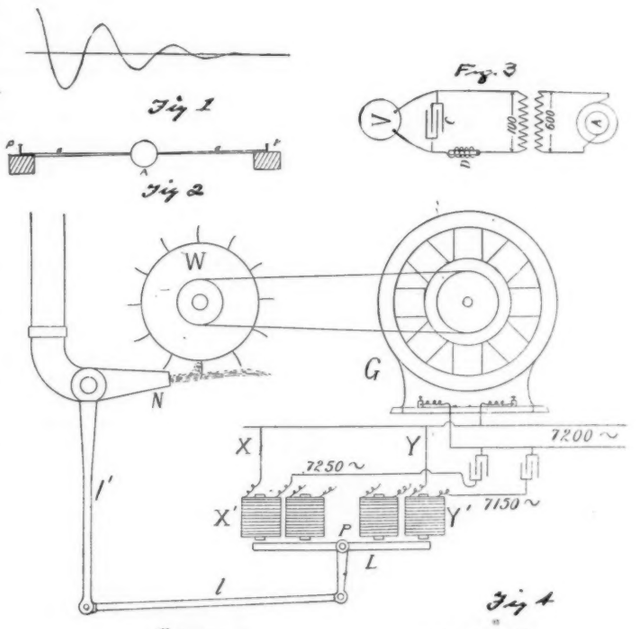
It has been proposed by several authorities to minimize the current in a line supplying the primary of a transformer by inserting a condenser in parallel with the primary of the transformer, and so adjusting its capacity as to neutralize the self-induction. In an investigation of the hedgehog transformer made several years ago by Dr. Bedell, G. F. Wagner and myself, we succeeded in reducing the current in the line to .18 ampere, although a current of one ampere flowed in the primary coil of the transformer.

The automatic governing of the speed of prime movers and other motors has, heretofore, been affected by one of the following agencies; viz., the centrifugal force or inertia of some moving part of the machine or of some machine driven by it, or by the variation of an electric current or an electro-motive force generated directly or indirectly by it. It can not be denied that these agencies are not absolutely dependent upon the speed of the machine which it is desired to govern. Again, it can not be denied that the periodicity of an alternating current depends solely and absolutely upon the speed of the alternator producing it. The only thing that would change the frequency of a given alternator would be for one of its poles to drop off, or, by some mysterious method, to have it pick up another. It occurred to me some years ago that, inasmuch as the periodicity of an alternating current seemed to be its only attribute absolutely dependent upon the speed, this would afford a simple and reliable method of governing the speed of almost any prime mover or motor.

Taking a typical case, we will refer to Fig. 4, which is merely diagrammatic and intended to illustrate a principle only. W is a motor, we will say a Pelton water wheel; G is an alternator driven by it. It is desired to run this alternator at a speed which will produce in the line circuit F F 7,200 alternations per minute. Across the mains F F are bridged two circuits X and Y, each containing a condenser C and a solenoid or magnet X^1 and Y^1 respectively. It will be seen that these two circuits contain both self-induction and capacity. The circuit X is tuned to a frequency a little higher than the normal rate of alternation, say 7,250, while the circuit Y is tuned a little below the normal frequency, say 7,150. The solenoids or magnets X^1 and Y^1 operate upon opposite ends of the lever L pivoted at P. An arm of this lever is connected to a connecting rod 1, the other end of which is connected to a lever 1^1, attached to the nozzle N which supplies water to the buckets on the wheel. By moving 1^1 back and forth the jet is so pointed that more or less of the water impinges against the buckets and, consequently, more or less power is imparted to the wheel (this shifting of the nozzle is a very common and successful method of governing water wheels of this class). Now, suppose that, for any reason, the speed of the motor rises and a periodicity of 7,250 alternations per minute is reached. As circuit X is resonant for that periodicity, that circuit will at once take current and the left-hand end of the lever will be pulled upward by the magnet X^1; the rod 1 will be pushed to the left; the nozzle N will be pulled down; the jet will partially clear the buckets on the wheel and the motor will slow down. On the other hand, suppose the speed decreases. A periodicity of 7,150 will be reached. The magnet Y^1 will now take current, its circuit being resonant for that frequency. The nozzle M will be moved upward, more water will impinge against the buckets and the speed will increase. In practice it probably would be better to have the resonant circuits operate relays which will control some mechanical movement so as to move the nozzle in one direction or the other.

It is obvious that this principle may be applied to motors of any type. For instance, the resonant circuits might be made to control a rheostat in the field of an electric motor, or the valve gear of a steam engine.

Messrs. Hutin and LeBlanc, of Paris, France, have done much work



DIAGRAMS ILLUSTRATING PAPER ON "SOME PRACTICAL ASPECTS OF ELECTRICAL RESONANCE."

tending toward the utilization of resonance, and one of their inventions, patented in this country, is exceedingly interesting. It is a system of multiplex telephony, and, with one exception, is the only purely multiplex system yet devised. Although it is fraught with innumerable disadvantages, and is at present entirely impracticable, it is well worthy of our consideration.

The sounds composing articulate speech are each capable of being resolved into a number of components, each a simple musical tone. The lowest of these tones is the fundamental, the others being its harmonics, or overtones. The quality, or timbre, of a composite sound depends on the number of its overtones, and on the relation of their respective intensities to each other and to the fundamental. By recombining all the components and giving to each its proper strength, the original sound may be reproduced. If, however, instead of recombining all the components of a sound, we select only a part of them, the resultant sound will not be exactly the same as the orginal, but will differ only slightly from it and be readily recognizable, provided, of course, too great a number of components be not omitted. To accomplish this analysis and synthesis of sound, Messrs. Hutin and LeBlanc make use of the fact that an alternating current of one particular frequency only will be transmitted through a resonant circuit, while currents of all other frequencies will be so greatly reduced as to be relatively insignificant. A combination of a condenser and self-induction coil is called by them an "electric resonator", it being understood that a circuit containing such a combination will select one particular frequency of current to the exclusion of all others, just as a Helmholtz resonator will select a particular frequency of sound vibration. A combination of several electric resonators, arranged in multiple, is called by them an "electric-current selector".

Fig. 5 shows, diagrammatically, a telephone system between two cities, A and B. To each end of the line wire, 1, 2, connecting these cities, are connected three selectors, d, f, g, and d^1, f^1, g^1, each composed of a number of parallel circuits containing condensers and self-induction coils, or, in other words, a number of resonators. To the other side of each selector is connected, by the wires a, b, c, and a^1, b^1, c^1, respectively, a telephone set (represented here by the receiver only), the other terminal of which is grounded.

As will be noticed from the diagram, the various resonators of the selectors d and d^1 are tuned to frequencies of 100, 200, 300, 1,000 alternations per second, respectively; those of selectors f and f^1 to frequencies of 105, 210, 315, 1,050, and those of g and g^1 to frequencies of 110, 220, 330, 1,100. Each selector, therefore, has a range corresponding to a fundamental tone and nine of its harmonics.

Now, suppose a sound to be uttered in front of telephone set R connected to the selector d^1 in the city A. An alternating current will be generated in the usual manner, and will flow from the ground at that instrument to the selector d^1. Of all the components of this complex wave, only 10 will be transmitted through this selector to the line wire 1, 2, these 10 having frequencies of 100, 200, 300, 1,000 alternations per second. At the other end of the line these components will only find passage through the resonators of the selector d, and will be barred from passage through the selectors f and g, these latter having no resonators tuned to those particular frequencies. After passing through the selector d the components are reunited, and produce in the corresponding receiver R, in the city B, a sound closely approximating that uttered in the transmitter corresponding to the selector d.

The current selector, corresponding to any telephone instrument, therefore, transmits to the line 10 of the components of the complex current generated by the voice, and the corresponding selectors at the opposite end of the line pick out this particular 10 from all others that may be coming over the line at the same time, and recombine them into a resultant complex alternating current, capable of producing in the receiver, at the receiving station, a sound almost, but not quite, a correct reproduction of the original.

To those who have attempted to obtain a delicate adjustment of the capacity and the coefficient of self-induction of a circuit to any desired frequency, the difficulties of this system appear especially great. But whether they are small or great, whether the ideas are practicable or impracticable, no one can deny the beauty of the conception and the nicety with which known physical laws have been utilized in this effort to bring the telephonic art to a higher degree of perfection.

None of the methods herein described have come into general use. The construction of condensers is at present far from perfect. They are expensive, liable to frequent breakdowns, especially when subjected to high electro-motive forces and are very susceptible to moisture and changes in temperature. Moreover, their use is accompanied by considerable loss, due to dialectric hysteresis, although this loss is not as great as that of magnetis hysteresis in iron. It seems, however, that a phenomenon so beautiful must find more general use in engineering works.

It affords another tool to the inventor, the engineer and the scientist with which to better existing methods or to accomplish some end hitherto unattainable.

NEWS OF THE TRADE.

A number of second-hand street cars have been placed in charge of Huntress & Ewing, 8 Oliver street, Boston, for sale.

The American Endoscopic Company, Providence, R. I., are manufacturers of a number of styles and forms of miniature lamps.

August Becker, 34 Oliver street, Boston, Mass., for the last year has given special attention to the making of name plates for electrical machines and apparatus.

It is said that the new factory of the Lynn Incandescent Lamp Company at Lynn, Mass., is about ready for occupancy, and that this company will utilize it, in addition to their present facilities, in their work of reconstructing incandescent lamps.

The Mianus Electric Company, Mianus, Ct., are manufacturers of a very complete line of telephone instruments for exchange, factory and interior service, and also telephone parts, such as receivers, hooks, grooves, and telephone woodwork. They have just published a new catalogue illustrating the various electrical specialties produced in their factory

The Automatic Circuit Breaker Company, Newaygo, Mich., are the manufacturers of an automatic, non-arcing circuit breaker, which has been widely adopted by central stations, and which is guaranteed to operate perfeotly for any voltage and is made for alternating or direct current.

In a recent issue the new arc cut-out box, invented and patented by Mr. T. H. Brady, the manufacturer of arc light specialties, was illustrated. This cut-out box has a number of important features in connection with its insulators, which strongly recommends it where the best form of construction is desired.

Hunter Fan and Motor Company, Fulton, N. Y., report an unusually early and strong demand for the "Tuerk" alternating-current ceiling fan, and their general selling agents, E. B. Latham & Company, 136 Liberty street, New York, speak most encouragingly as to the substantial growth of this feature of electrical manufacture.

The Viaduct Manufacturing Company, one of the oldest and best known manufacturers of telephone apparatus in the independent field, is operating a very large force of men—over 80, it is said—at their factory near Baltimore. The Viaduct power generators are universally recognized as standard and are very widely in use.

Mr. T. C. Perkins, who has been active in the electrical and mechanical fields with the Mather Electric Company, of Manchester, Ct., and later with the Providence Engine Company, Providence, R. I., has accepted a connection with the Armington & Sims Engine Company, of Providence.

The shops of the New Haven Car Register Company, according to a remark of President Branly, are exceedingly busy with an unusually large Spring business. This company's fare register has been adopted, during the past two years, by a large number of the most important street railroad companies.

The Proctor-Raymond Manufacturing Company, Buffalo, N. Y., which was recently incorporated with a capital stock of $30,000, are now very actively perfecting their shops so as to have very much larger facilities for the production of their line of electrical specialties, which include push buttons, annunciators and a number of forms of electric bells.

The Dale Automatic Car Brake Company has been recently organized in Kansas, and the place of manufacture will be Topeka. Those interested in the enterprise are said to have ample capital and experience to push it to success. J. S. Dale, the inventor, is from Manhattan, Kas. The brake is guaranteed to catch and hold a runaway car on an incline.

Mr. Josiah Stedman, who will be remembered as one of the old-timers in the electrical field, has finally left the ranks, and is now treasurer of the American Mining Company, Chicago, which is developing some gold mines in the Pine Creek mining district, Colorado. Mr. Stedman has a host of friends who, with the ELECTRICAL REVIEW, wish him the best of luck in his new venture.

The Chas. E. Gregory Company, 47 and 49 South Jefferson street, Chicago, is one of the many concerns that report a decided improvement in business, so much so that it recently found it necessary to secure the second floor of the adjoining building—Nos. 51 and 53—which will be devoted to the repair and storage departments. General Manager Kuehmsted has just returned from a four weeks' business trip through the East, where he secured a carload of electrical bargains.

Whitman & Couch, 196 Summer street, Boston, American agents for the Ericsson Swedish telephones, are having excellent success in the introduction of the various forms of this instrument. The Swedish microphone seems to give excellent satisfaction, in many instances, in comparison with the American forms of transmitters, and this company have installed, in the past few months, a very large number of factory and intercommunicating systems and private lines.

The Anchor Electric Company, Boston, Mass., have just issued a very complete catalogue, in convenient form, of the electrical specialties which they carry. The catalogue is fully illustrated and is of importance to those active in the electrical industry, as it shows the latest improved forms of electrical apparatus in construction specialties. The ELECTRICAL REVIEW is asked to announce that they will be glad to send this catalogue, upon request, to any one in the New England States.

The L. E. Knott Apparatus Company, 14 Ashburton place, Boston, have already received a number of very strong testimonials as to the value of their static X-ray apparatus, the new form of which has just been perfected. In a note from one of the first users, Dr. C. B. Herrick, surgeon of the Fitchburgh & Delaware & Hudson Railroad, this remark appears: "I consider the apparatus (referring to the new form) the best yet designed for practical application and it will undoubtedly prove an invaluable aid to surgery."

The various types of switchboard, voltmeters, ammeters, ground detectors and differential voltmeters, made by the Keystone Electrical Instrument Company, Philadelphia, are gaining better recognition than ever before. A number of changes and improvements have been made in these instruments, and the company is aiming to make them known as absolutely reliable and perfect in every detail. Mr. J. F. Stephens, Jr., has taken the active management of the company, and the introduction of the Keystone instrument will be vigorously pushed.

Mr. J. H. Cooke, the energetic exploiter of the Manhattan arc lamp in Chicago, recently contributed his share toward making Chicago known as the rapid city when it comes to filling orders calling for quick delivery. The firm of H. H. Kohlsaat & Company placed an order for a number of arc lamps with Mr. Cooke on Saturday afternoon at three o'clock, on condition that the lamps were installed the following morning (Sunday). In view of the fact that the lamps had to be ordered from the Cleveland factory and were burning brightly the next morning, some people are still asking, "How was it done"?

Though the history of the induction coil has been published in the ELECTRICAL REVIEW, it is of particular interest at this time, in view of the many adaptations of this apparatus, to mention that the form of construction usually adopted by the present day manufacturers was invented away back in the fifties by Mr. E. S. Ritchie, the founder of the firm of E. S. Ritchie & Sons, Brookline, Mass. This company, since that time have systematically developed and improved the induction coil, the method of construction, its adaptation and use, are now making special forms for X-ray work. This company are looked upon by many as the fathers of this piece of apparatus.

The consolidation of the Kester Electric Manufacturing Company and the Buffalo Electric Company, of Buffalo, N. Y., is announced, a copartnership having been formed between Mr. J. F. Kester and Mr. Wells Dygert, and the house will be known as the Buffalo Electric Company. Both gentlemen are well known in the electrical field, Mr. Dygert having been sole owner of the Buffalo Electric Company, which has done a large local electrical supply business for a number of years, and Mr. Kester is known as the designer of a successful line of motors and dynamos, an early experimenter with the telephone transmitter, and an inventor of many small electrical specialties which have come into general use in electrical work, such as soldering salts, dry batteries and an aluminum-core dynamo brush.

The Chapman Voltage Regulator.

The accompanying illustrations show the Chapman voltage regulator, manufactured by the Belknap Motor Company, Portland, Me. The manufacturers furnish the following description of the apparatus:

The economical and efficient operation of a plant of incandescent electric lamps involves the nice adjustment of two opposing factors which enter as items of expense. As one item is increased in any given case, the other is decreased, and vice versa. These two factors are, on the one hand, the life of the lamps, and on the other hand, the power consumed in operating the lamps. The life of a lamp is favored by making it a great watt consumer. A lamp using four watts per candle-power has a much longer life, other things being equal, than a two and one-half-watt lamp, but the power used makes it expensive to operate. And on the other hand, the two and one-half-watt lamp, when subjected to fluctuations of voltage, becomes expensive in the item of lamp renewals. Close regulation is important for any lamp, but when the low-watt lamp is used, it becomes an all-important factor in economy, and it is not infrequent to see in a lighting station one or more attendants constantly engaged watching the voltmeter, and operating a hand rheostat as the changes of load or speed demand.

The high-watt lamp is necessarily expensive in the item of power, and the low-watt lamp is also expensive in the item of lamp renewals when the regulation is poor. But the low-watt lamp, combined with perfect regulation, is the perfection of economy with incandescent electric lighting. Every intelligent station manager fully appreciates this fact, and a good voltage regulator is the urgent demand of the times, and this demand is fully met in the new Chapman voltage regulator, which the Belknap Motor Company are now putting on the market. A large number of these have been put out and are in practical operation, and have proved to be all that could be desired. The regulator is a magnetic device and acts very promptly, being only limited in quickness of action by the ability of the generator it may be regulating to respond to change on a field rheostat. The device is essentially a field rheostat, whose operation is entirely automatic. The moving of the rheostat arm is accomplished by the action of a working solenoid, and the actions of the working solenoid are determined by those of an auxiliary solenoid which operates a set of contacts that control the admission of current to the sections of the working solenoid. The working solenoid is differentially wound and is composed of four distinct coils, two of which have a small continuous current flowing through them, in mechanical opposition to each other; the contacts close the circuit of one or the other of remaining coils, and so neutralize the action of one of the continuously acting coils.

This manner of connecting secures a rise of magnetism in the iron core of the solenoid whenever a break occurs at the contacts, and so avoids any injurious sparking at the contacts that would naturally occur by the magnetic discharge of the core. The arrangement completely neutralizes the induction spark, and no induction spark can occur. All of the usual objections to contact points are, therefore, entirely removed, and we may set them very close and secure the most sensitive adjustment of the apparatus.

The entire work of the auxiliary solenoid is to move a lever arm, with

contact attached, through a short space of, say, one-thirty-second inch, and a very slight change of voltage is sufficient to do this. It is often desirable to have the voltage at the generating station rise a little with the load, so that it becomes greater than the voltage at the distributing center, where it remains constant with changes of load. This result is aimed at in the compound winding of the generators, but, in most cases, is far from securing the result desired, on account of the changes of speed, which no compounding of the generator can compensate for. The compounding of this auxiliary solenoid, however, secures the desired result under all conditions of speed and load, and a plain, shunt-wound generator becomes just as effective as a compound-wound generator. And the use of the Chapman voltage regulator enables the old-style, alternating-current generators having no compound coils to do just as good work as the more modern apparatus. Many machines that have been discarded as out of date will again become valuable and equal to the best.

And the same is also true of direct-current generators. There are many old generators of the shunt-wound type that will become just as useful as the more modern-built machines, and even more so, by the attachment of the voltage regulator to them.

As to the energy consumed in the

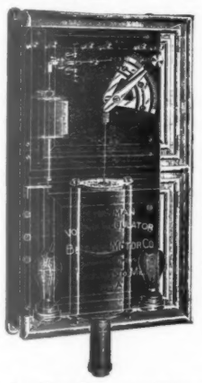


FIG. 1.—THE CHAPMAN VOLTAGE REGULATOR.

regulator, it is so small as to be negligible. The operation of the large working solenoid only required the use of 60 or 70 watts of energy, and the rheostatic part of the device is concerned only with the current in the shunt winding of the generator, which, as is well known, is only a very small percentage of the output of the machine. So that the regulator may be operated on a machine of 150 kilowatts, with an extra expenditure of energy not exceeding one-fourth horse-power.

ELECTRIC RAILWAY NOTES.

The Pullman works, at Chicago, Ill., are constructing a number of double-decked trolley cars for street railways. The earning capacity of one of these cars is claimed to be greater than two ordinary cars.

The Cambridge, Mass., city government has been petitioned to grant the West End Railroad permission to lay conduits through certain streets, which, if granted, the company will at once begin the erection of a $400,000 power house.

A bill has been introduced into the Massachusetts Legislature authorizing any railroad corporation in the State to construct along public highways branches of its main line to be operated as electric roads and under the same terms as street railways.

The New York and North Shore Railway Company, which intends to build electric railroads on Long Island, was incorporated on March 13. The capital stock of the new company is placed at $1,000,000, and the directors for the first year are Rudolph T. McCabe, William R. Heath, Garret H. Perkins, Eugene L. Bushe and Walter A. Pease, of New York city; Edward J. Mathewson and William H. Shelmerdine, of Philadelphia; James B. Bach, of East Orange, N. J., and Clarence S. Simpson, of Scranton, Pa. The company is given permission to build a surface road 20 miles long, either double or single track, and to use any motive power except steam.

The attachments for $20,000 placed on the property of the Woonsocket, R. I., Electric Machine and Power Company by the Electric Storage Battery Company, of Philadelphia, have been released and the suits withdrawn, the companies having come to an agreement on the matter of the terms of installation of the storage battery for street railway service.

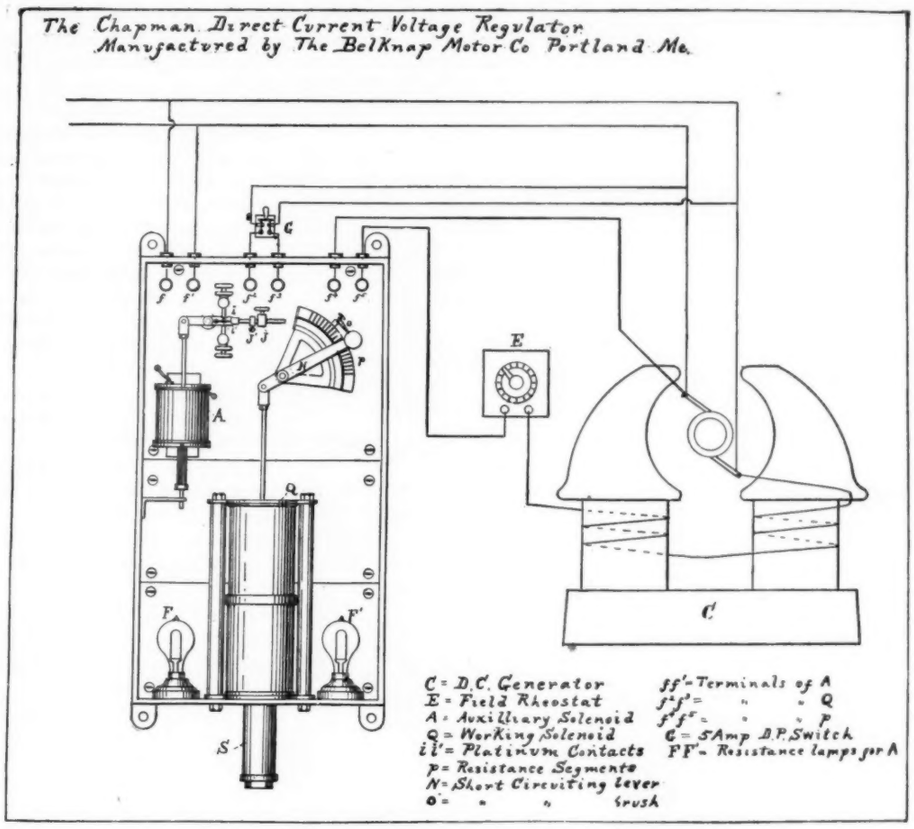

The Chapman Direct Current Voltage Regulator
Manufactured by The BelKnap Motor Co Portland Me.
C = D.C. Generator
E = Field Rheostat
A = Auxiliary Solenoid
Q = Working Solenoid
i i' = Platinum Contacts
P = Resistance Segments
N = Short Circuiting lever
O = " " Brush
ff' = Terminals of A
f'f' = " " Q
f'f' = " " P
G = 5 Amp D.P. Switch
FF' = Resistance lamps for A

FIG. 2.—THE CHAPMAN DIRECT-CURRENT VOLTAGE REGULATOR.

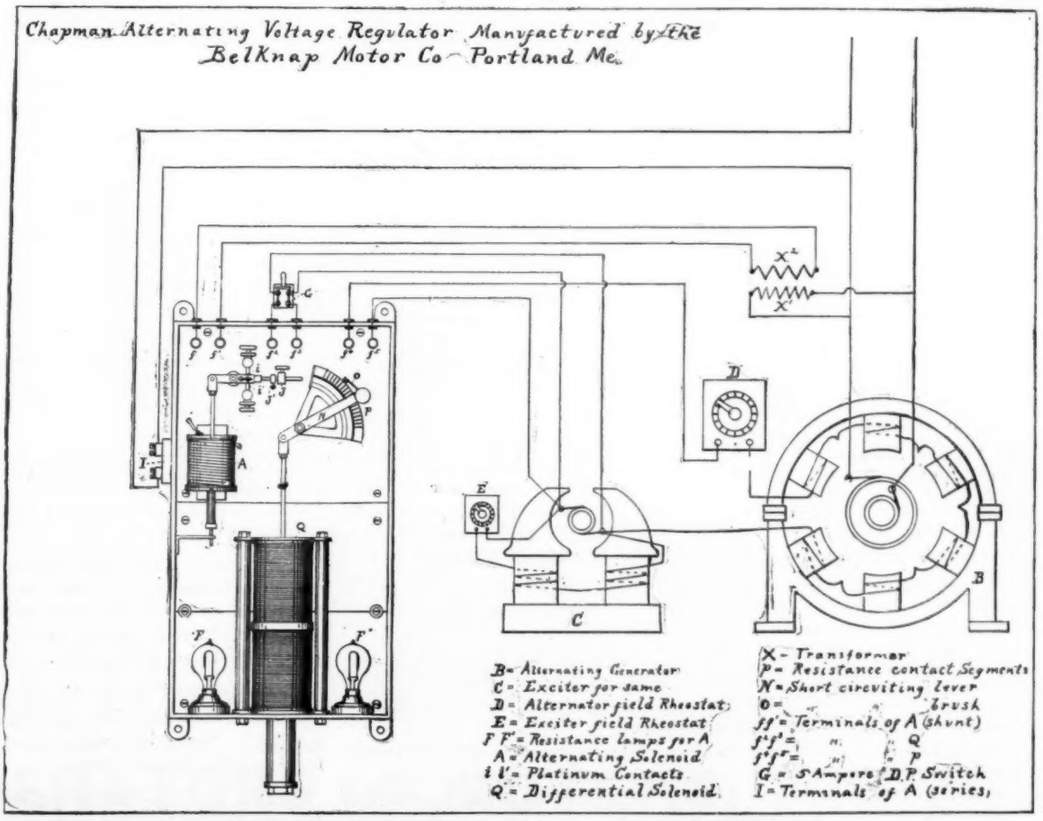

Chapman Alternating Voltage Regulator Manufactured by the
BelKnap Motor Co Portland Me.
B = Alternating Generator
C = Exciter for same
D = Alternator field Rheostat
E = Exciter field Rheostat
F F' = Resistance lamps for A
A = Alternating Solenoid
i i' = Platinum Contacts
Q = Differential Solenoid
X = Transformer
P = Resistance contact Segments
N = Short circuiting lever
O = " " Brush
ff' = Terminals of A (shunt)
f'f' = " " Q
f'f' = " " P
G = 5 Ampere D.P. Switch
I = Terminals of A (series)

FIG. 3.—THE CHAPMAN ALTERNATING-CURRENT VOLTAGE REGULATOR.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

MIDDLEBURG, KY.—The new telephone line from this place to Stanford is now an assured thing, as more than a sufficient amount has been subscribed to build it. The line will intersect the Hustonville and Green River telephone at Mt. Salem, and will give Casey and Lincoln counties close connection.

TULARE, CAL.—The Mount Whitney telephone line, running from Springville to this piace, a distance of 50 miles, taking in the towns of Globe, Pleasant Valley, Porterville, Visalia, Lindsay, Exeter and Farmersville, all in Tulare County, has been completed. The line will be extended to all the large orchards and ranches of the county.

PAULDING, OHIO—The Paulding Home Telephone Company has been incorporated, with a capital stock of $10,000. Besides making an exchange for Paulding, the company will build toll lines connecting Ottawa, Scott, Hicksville, Cecil, Tipton, Grover Hill, Paulding and Defiance.

MARYSVILLE, GA.—W. T. Thurmond has the contract to build the telephone line from this place to Gainesville.

LATTA, S. C.—The Murchison Telephone Company has been incorporated by Alex. J. and Julian J. Murchison, to construct a telephone line from Latta to Bennettsville. Capital stock, $1,000.

WESTMORELAND, KAS.—The Missouri Telephone Company will extend their line to Havensville.

PORT BYRON, N. Y.—A telephone line has been established between this village and the New York Central depot.

SING SING, N. Y.—It is proposed by the Home Telephone Company, of this village, which has just received a franchise from the trustees, to install a telephone plant immediately.

OWEGO, N. Y.—A new telegraph line is to be constructed between Owego and Ithaca along the Cayuga division of the Delaware, Lackawanna & Western Railroad. The poles for such line have already been scattered along the route.

LA BELLE, MO.—A telephone system is to be established here within the next 60 days.

SOUTHBRIDGE, MASS.—F. D. Constantine has been appointed superintendent of the telephone system for this place and Webster.

YONKERS, N. Y.—The Yonkers Telephone Company has been incorporated for constructing and maintaining lines of electric telephone wholly within, or partly beyond, the limits of this State; capital stock, $150,000. Directors, Peter G. Kemp, Theodore D. Coe, Dr. George M. Ball, William Fairchild, William E. Hills, Harry M. George and Hal Bell, all of New York city.

SALEM, ORE.—The Metropolitan Telephone Messenger Company has been incorporated to operate an invention, known as the combined district telegraph and telephone system; capital, $35,000. Principal place of business, Portland. Incorporators, J. H. Hawley, S. G. Fulton, C. D. Brunn, W. T. Wallace and D. Solis Cohen.

ALBANY, N. Y.—The New York State Telephone Company has been incorporated to maintain a line in the counties of Madison, Oneida, Herkimer, Niagara, Montgomery, Fulton, Oswego, Schenectady, Albany, Otsego, and adjoining and other counties; capital, $200,000. Directors, Isaac J. Evans, of Rome; William Clark, John D. Wendell and Willis E. Dieffendorf, of Fort Plain; George McClumpha, of Amsterdam; Frederick Engelhardt, of St. Johnsville, and Elmer E. Summey, of Buffalo.

WOODSTOCK, VA.—A telephone company has been organized at this place for the purpose of connecting all the towns and villages in Shenandoah county.

ROGERSVILLE, TENN.—A telephone exchange has been started in this place. There are nearly 50 subscribers.

BOULDER, COLO.—A project is on foot to build a telephone line from this place to Magnolia, and also to El Dora.

LA BELLE, MO.—A telephone system is to be established here within the next 60 days, and also an electric light plant.

LAKE HUNTINGTON, N. Y.—The Lake Huntington Telephone and Telegraph Company has been incorporated to operate a line of telephone connecting this place, Oil Pumping Station, Cochecton, Cochecton Centre, Narrowsburg, Fosterdale, Kenoga Lake and Jeffersonville, all in Sullivan County. Capital, $2,000. Directors, William H. Lawrence, Charles Homer, Wilhelmina Homer, of Jeffersonville, and others.

EL PASO, TEX.—A quadruplex telegraph service is being installed on the line of the Mexican Central Railroad from this place.

Electric Light and Power.

GREENUP, KY.—John L. Soward may be addressed concerning erection of electric light plant.

RALEIGH, N. C.—The Raleigh Electric Light Company will build a $35,000 electric light plant, to take the place of the one which was destroyed by fire last Summer.

WASHINGTON, LA.—City Clerk may be addressed concerning electric light plant.

AYER, MASS.—William M. Sargent will erect new building and put in a larger dynamo to furnish electric lights.

LANCASTER, KY.—G. M. Patterson has been awarded contract for the establishment of an electric light plant.

JELLICO, TENN.—The citizens of this place are discussing the feasibility of erecting an electric light plant.

GLADSTONE, MICH.—As the Gladstone Electric Light Company will not rebuild its burned lighting plant the City Council have decided to put in a municipal plant capable of carrying 40 arc and 1,000 incandescent lights.

WHITE PLAINS, N. Y.—The Pelham Electric Light and Power Company has been incorporated; capital stock, $100,000; principal business office, in New York city; operations of the corporation to be carried on in the county of Westchester and city and county of New York; directors, Charles W. Smith, John F. Boyd, Thomas F. Conville, Joseph A. Spratt, all residents of New York city.

COCHRAN, GA.—Town Council may be addressed concerning erection of electric light plant.

FITZGERALD, GA.—The Mayor may be addressed concerning establishment of electric light plant.

NEWARK, N. J.—The Center Market Building is being rewired for electric lights.

OLNEY, ILL.—M. D. Foster, Mayor, may give information concerning establishment of electric light plant.

APPLETON, MINN.—Edwin Pickthorn and Albert S. Williams have been granted a franchise to erect and run an electric light plant.

CLAREMORE, ARK.—Electric lights are to be established here.

HANCOCK, MICH.—Village Clerk may be addressed concerning erection of electric light plant.

WASHINGTON, LA.—A. J. Muller, Mayor, may be addressed concerning erection of $15,000 electric light plant.

SUFFIELD, CT.—W. W. Cooper may give information concerning erection of electric light plant by Electric Light Company.

New Electric Railways.

PORTLAND, ME.—The Portland & Rochester Railway officials contemplate the construction of a trolley line.

NORTH EASTERN, MASS.—Taunton & Brockton Street Railroad Company; meeting of Selectmen held recently, regarding construction of electric railroad.

WINSTED, CT.—Henry Gay may be addressed concerning construction of trolley line between Winsted and Torrington.

WATERTOWN, MASS.—The Newton Street Railway Company has been granted permission to lay tracks and operate cars by electricity on Pleasant and Bridge streets in that town.

THOMPSONVILLE, MASS.—An electric road is to be built from Thompsonville to Somerville, and surveys for same are now being made.

KEENE, N. H.—The Springfield Electric Railway has been organized. The line will extend from Springfield, Vt., to Charleston, N. H.

BRIDGETON, N. J.—The South Jersey Traction lines were sold at auction recently, and were purchased by F. L. Lewis, trustee, for $90,000.

New Incorporations.

FOSTORIA, OHIO—The Fostoria Incandescent Lamp Company has been organized, with a capital of $100,000, with the following directors and officers: B. G. Tremaine, of Cleveland; H. A. Tremaine, J. B. Crouse, R. Crocker and I. Cadwallader. The officers are: President, J. B. Crouse; vice-president, R. Crocker; secretary and treasurer, H. A. Tremaine. It is expected that work on the buildings will be started not later than March 20, and that they will be completed and have the machinery in them by June 1. The buildings will be of brick and will have a capacity of 2,500 lamps per day, giving, when running at full capacity, employment for 200 people. The company is composed wholly of Cleveland and Fostoria capitalists.

NASHVILLE, TENN.—The Electric Supply Company has been incorporated by L. G. McDonald, S. T. Carnes and others.

UKLAH, CAL.—Mendocino County Electric Company has been incorporated by William V. Lockwood, Philip S. Taylor, Frank Morse, W. A. Hagans, T. A. Templeton. Capital stock, $20,000.

SAN FRANCISCO, CAL.—Acme Electric Manufacturing Company has been incorporated by W. T. Y. Schenck, M. S. Schenck, L. St. D. Roylance, S. B. Peterson and F. J. Dyer. Capital stock, $50,000.

LOS ANGELES, CAL.—The Wybro & Lawrence Company has been incorporated for the purpose of carrying on the business of buying and selling electrical supplies, and conducting electric engineering generally. The amount of the capital stock is $50,000. The directors named are as follows: H. C. Wybro, G. W. Lawrence, Sr., G. W. Lawrence, Jr., L. R. Boynton and F. W. Burnett, all of Los Angeles.

Business Troubles.

INDIANAPOLIS, IND.—On application of John Donn, of Chicago, Judge Baker, of the Federal Court, has appointed Charles D. Johnson as receiver of the Madison Light and Railroad Company. The company operates an electric light plant and a street railway in that city.

CLEVELAND, OHIO—A deed of assignment was filed in insolvency court by the Hafemeister Electric and Machine Company, located at No. 24 Superior street. Walter E. Hauser was named assignee.

Increase of Capital.

BELVIDERE, ILL.—The Belvidere Electric Light Company has certified to a change of name to the Belvidere Light, Heat and Power Company; also an increase in capital stock from $35,000 to $125,000; also decrease in directors from eight to seven.

WESTFIELD, MASS.—Woronoco Street Railway; capital stock increased from $50,000 to $100,000, to build line to Springfield.

Kindred.... ...Interests

The H. W. Johns Manufacturing Company will move from their offices in Maiden lane to the new Woodbridge Building at William and John streets. We can not do more than wish them a continuance of the successes which they have attained in their old home.

The Western Electric Company, Chicago, is rapidly completing an extensive line of desk and ceiling fan motors of the direct-current type. They will be wound for 110, 220 or 550 volts, and for efficiency, beauty of design, as well as general durability, are claimed to be unsurpassed by anything on the market to-day.

The Western Telephone Construction Company, Chicago, has just closed a contract, at Lancaster, Ky., for 75 telephone equipments and a 100-line latest improved switchboard. The company is doubling its present factory capacity, and by May 1 next, expects to be ready to take better care than ever of its growing business.

The American Electric Heating Corporation, of Boston, announce as ready for market electric solder pots in two sizes, one to hold four pounds, using one and three-fourths amperes at 110 volts; a larger size holds ten pounds. They are easily portable and are, by far, the best device for this work ever offered. It is clear that neither gas nor gasoline heated pots can compare with them for cleanliness, convenience or close regulation of temperature. These pots are especially useful in electrical repair shops for tinning wire and similar uses. They are fully guaranteed.

Graphite for Resistance Purposes—For some years the Joseph Dixon Crucible Company, Jersey City, N. J., have been supplying graphite resistance devices in quite a large way to telephone companies, electric light companies and electricians generally. The resistances have been so satisfactory and the demand so promising that they have now added to that department of their works, dynamo and all necessary apparatus for testing purposes and are prepared to furnish graphite resistances in round or square rods, tubes, spirals and other devices as wanted, of one ohm resistance or one million ohms resistance, as required.

The Central Electric Company, Chicago, advise us that the prospects for business are exceedingly promising. The inquiries for their numerous specialties are daily increasing, which gives evidence that their customers are providing for a lively trade. It is quite evident that the Wagner direct-connected alternating-current ceiling fan motor, for which they are general Western agents, is bound to prove popular. It has many advantageous features, which seem to appeal to prospective users with unusual force. They are bringing out a new form of spark arrester, made entirely of Russia iron, and adapted to be used in connection with most any form of arc lamp. Circulars, fully describing this, are being sent out, and will be sent on application.

The Metropolitan Electric Company, of Chicago, have taken the agency of the Syracuse rail bond. This bond is said to be the only one on the market that utilizes the fish-plate holes and requires no drilling. It is soldered fast to the rail and the fish-plate bolts reinforce the joints, making absolutely homogeneous contact during the life of the rail, and giving a surface connection, between copper and rail, of 10 times the cross section of the bond conductors, thus making the best possible construction. In addition to this the Syracuse bond is economical, and will save coal bills, and is said to be endorsed, unconditionally, by the best engineers. The Metropolitan Electric Company has just issued circulars fully describing the rail bond.

The "Mascot" Dry Battery.

The first dry-cell battery that attracted any attention in this country, was the "Gassner", and a few thousand cells of that type were imported and sold at a high price. The enterprising house of J. H. Bunnell & Company, of New York city, with their usual foresight, believing that an efficient dry cell would find a ready sale, promptly put one on the market, and they state that they were the pioneers in bringing out the first practical, American made, dry battery.

THE "MASCOT" DRY BATTERY.

The excellence of this battery, together with the able manner in which it was handled, soon made it an acknowledged commercial success, and its sales are estimated to have reached about a million cells. Messrs. Bunnell & Company have recently improved and extended the facilities for making their "Mascot" dry cells, and the quality of these cells is guaranteed for strength, durability and recuperating powers.

WATER-POWER FOR SALE.

120 Horse-power. Turbine Water-wheel. Wheel-house. Two-story brick building, 36x171 feet; also main line of shafting. Power reliable. On two railroads. About four hours from New York and Boston.

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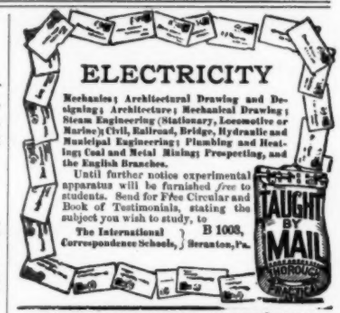

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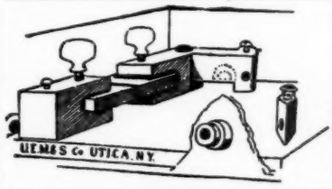

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Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED MARCH 9, 1897.

578,275 Electric circuit; J. S. Stone, Boston, Mass.—An electric conductor, consisting of a conducting core provided with a longitudinally discontinuous paramagnetic sheath, conductively separated from said conducting core.

578,280 Dynamo electric machine and electric motor; C. P. Turner, New York—The method of increasing the permeability of the field magnets of dynamos and electric motors, which consists in electrically depositing on the polar extremities of the field magnet a coating of iron.

578,298 Train controlling device; C. A. Shea, Milton, Mass.

578,304 Electric rail bond; B. J Jones, Chicago, Ill.

578,345 Thermal circuit-closer; H. F. Maxim, Norfolk, Va.

578,380 Call-ringer for telephones; J. A. Williams, Cleveland, Ohio—A tripolar magnet and an electro-magnet fixed between the legs of the magnet, whereby the lines of polarity in both of said magnets are on the same plane.

578,386 Telegraphic register; C. E. Beach, Binghamton, N. Y.—A magnet, a revoluble part containing projections capable of engaging with a latch, a latch operated by the magnet and controlling the motion of the revoluble part, and a slide or beam operated by the collision of the revoluble part and latch.

578,402 Car announcer; W. A. Heckard, Columbus, Ind.

578,420 Electric gas-lighter; F. N. Pike, New York.

578,430 Electric meter; Elihu Thomson, Lynn, Mass.—Consists of armature coils carrying a practically constant current, a main field producing or energizing coils in which a rotating armature moves, and an accessory or initial field circuit, supplied with current from any suitable source such as a derived circuit around the consumption devices, a constant battery circuit, or the like.

578,464 Contact finger for electric controllers; E. C. Parham, Johnstown, Pa.—A magnetizable finger member, means for magnetizing said member, and a contact carried by said member and carried between the poles thereof.

578,471 Electrical cane; W. N. Sherman, Merced, Cal.—A walking stick having a chamber therein, and a hollow handle combined with an electric battery, the parts of which are arranged within said chamber, and nested metallic electrodes attached to the handle of the cane and forming a part thereof.

578,520 Telephone transmitter; N. Lombard, Boston, Mass.—An apertured supporting ring, an internal circumferential flange thereon, a diaphragm loosely resting upon said flange, a pin centrally of said diaphragm, and a spring having its free end connected with the pin, the tension of said spring serving to normally maintain the diaphragm in a concavo-convex position.

578,549 Paper registering machine; T. C. Dexter, Pearl River, N. Y.

578,643 Electric cut-out; D. B. Kinch, Pittsburgh, Pa.—A socket plate, a plug adapted thereto and carrying the loop wire electrically to connect the same with the socket plate, and the switch lever pivoted on the socket plate, said lever being operated by turning the plug.

578,670 Telephone; J. Weigel, Boston, Mass.

578,673 Magnetic apparatus; A. Boetcher, Philadelphia, Pa.

578,695 Turn button for electric switches; J. S. Gibbs, Hartford, Ct.

ISSUED MARCH 16, 1897.

578,707 Controlling mechanism for electric motors; F. R. Bacon, Milwaukee, Wis.—A series of contacts, back-stops and electro-magnet of a rheostat, and a switch lever pivotally connected to a pin on said rheostat, a switch arm independently pivoted on said pin, and adapted to be held against the core of said magnet when the latter is energized, and a spring connected to said switch arm so as to always draw away from the magnet when the latter is de-energized irrespective of the position of the switch-lever.

578,710 Storage battery; C. T. Barrett, Brooklyn, N. Y.—A cell consisting of a plate of pumice-stone to which the peroxid or equivalent material is applied in combination with a confining envelop of lead having openings for the admission of the acidulated fluid.

578,716 Telegraph fire hose; J. Buchtel, Portland, Ore.—Consists of hose, pipe sections having a cut-off valve, cocks on each side of the said valve, the telegraph hose composed of sections carrying conductor wires, the signal apparatus, the nozzle and circuit closer.

578,725 Water indicator and alarm; G. W. Cooley and H. F. Logee, Minneapolis, Minn.

578,750 Circuit breaker; H. P. Kelly, Philadelphia, Pa.—A breakable strip included in the circuit, and mechanical means controlled by the circuit for mechanically breaking the strip without previously fusing it.

578,771 Cut-out and agitator for dust-transmitters for telephones; S. B. Rawson, Elyria, Ohio—The dust transmitter on a jointed arm, a battery wire connected to said arm and movable therewith, the bell connections having fingers in position to be engaged and thrown into circuit by said arm in one position, and the transmitter having a finger connected to the battery circuit and in position to be engaged by the arm when in another position.

578,823 Charging secondary batteries; Isidor Kitsee, Philadelphia, Pa.

578,825 Insulator; H. H. Luscomb, Hartford, Ct.—Consists of a body provided with means for attachment to a support, and having arms that project upwardly from opposite sides of the body near the top, fingers loosely connected with and movable between the arms, a part of the fingers being adapted to support the wire, and a part of the fingers being caused to embrace the wire by the action of the weight of the wire.

578,840 Railway crossing signal; C. Selden, Baltimore, Md.

578,853 Arrangement for closing or opening bars at railroad crossings; H. Biermann, Breslau, Germany.

578,867 Electric battery; H. N. Farley, Warwick, N. Y.

578,887 Paste for electric accumulators; R. Linde, Berlin, Germany—A filling paste for electric accumulators, consisting of the lead oxides with a bitter principle.

578,893 Burglar alarm; M. P. McDermott, Auckland, N. Z.

578,939 Electric carrier apparatus; H. M. Neer, Springfield, Ohio.

578,954 Electrical controlling apparatus; B. C. Van Emon, San Francisco, Cal.—A triple oscillating reversing switch, mounted and turning on an axis, with a series of parallel contacts at both sides, two solenoids to move the switch, and a spring or springs to disengage and hold the same out of contact.

578,976 Electric clock-setting device; C. M. Crook, Chicago, Ill.

578,981 Lightning arrester; W. K. Freeman, Fort Wayne, Ind.

578,992 Multiplex telephony; S. W. Holman, Boston, Mass.—Two original metallic telephone circuits, each consisting of two conductors and a telephone at each end of each, two wires connecting the two conductors of an original circuit to the two conductors of the other original circuit, said wires being differentially wound about a magnetic core.

578,997 Repeater; C. W. Leiser, Carlinville, Ill.

579,001 Battery; S. J. Martin, Detroit, Mich.—An electrode, consisting of a series of perforated tubes attached to and surrounding a central core, said tubes adapted to contain the active material.

579,003 Telephone transmitter; W. J. Moore, Elmer, Mich.

579,012 Dynamo-electric machine; G. A. Scheeffer, Peoria, Ill.

579,024 Electric elevator; S. D. Strohm, Philadelphia, Pa.—An elevator car, an electric motor for operating the same, a switch controlling the circuit of said motor, a solenoid or magnet for operating said switch, a safety circuit including said solenoid or magnet, and a series of closers or breakers in said safety circuit controlled by the landing door.

579,028 Controller for dynamo-electric machines; C. E. Woods, Chicago, Ill.

579,032 Electric arc lamp; T. E. Adams, Cleveland, Ohio.

579,036 Telephone switchboard plug; Frank E. Bossong, Watseka, Ill.—The combination with a central signaling current generator, and a central operators telephone set, of a telephone switchboard plug, suitably connected therewith, and wired to connect two subscribers' lines, means for cutting the calling subscriber and signaling current generator alternately into circuit with the second subscriber, and means for maintaining the central operators' telephone set constantly in circuit with said second subscriber, during such alternation.

579,059 Construction and regulation of electric machines; T. H. Hicks, Detroit, Mich.—A machine provided with field-magnets, each having polar lips and a short circuiting magnet magnetically joined to only one polar lip of each field-magnet.

579,062 Electric motor and dynamo; W. S. Horry, Gloucester City, N. J.

579,063 Regulator for electric motors; R. M. Hunter, Philadelphia, Pa.

579,075 Electrical call and call-answering apparatus; E. H. Owen, Garvanza, Cal.

579,079 Electric meter; A. Raps, Berlin, Germany.

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